PAGE'S WEEKLY.—August 4, 1905. Thin Paper Copy for Circulation Abroad.

No. 47. Vol. 7.
SIXPENCE.
(Registered as a Newspaper.)
FRIDAY,
AUGUST 4, 1905.

269

PAGE'S WEEKLY

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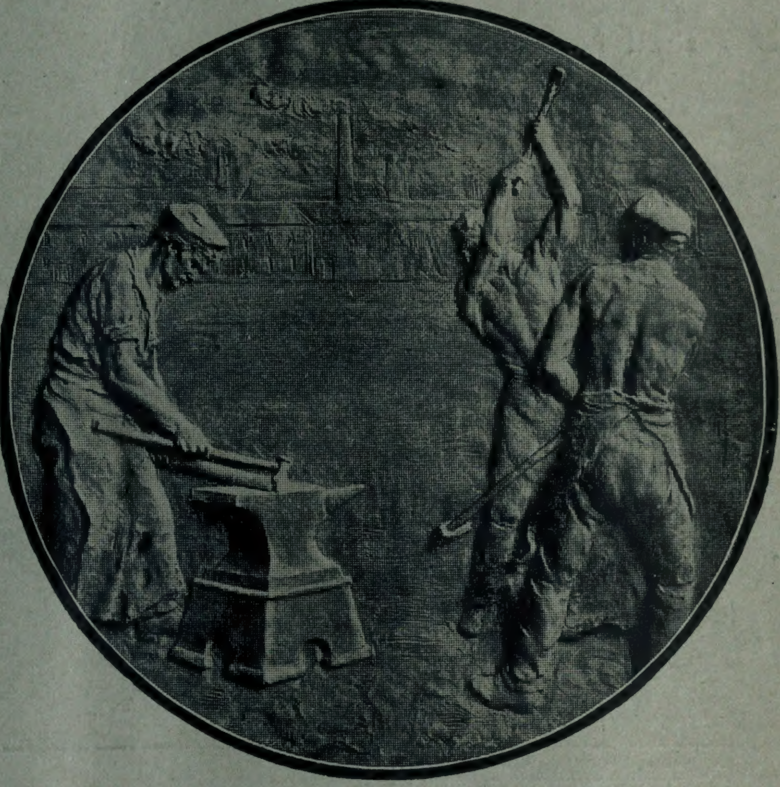

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PAGE'S WEEKLY Miscellaneous

Mr. G. H. HUGHES, M.I.Mech.E.,

Consulting and Organising Engineer for Water Works and Industrial Undertakings,

97, QUEEN VICTORIA ST., LONDON, E.C.

Telephone No.: 5754 Bank. Write for particulars.

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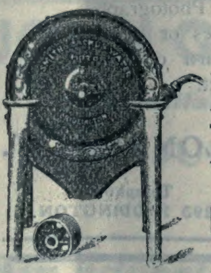
See our Advertisements in last and next week's Issues.



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Will drive any class of Machinery, and work on 15 lb. pressure.

ERIC S. A. SMITH, ENGINEER,
APPLY FOR CATALOGUE. **BRIDLINGTON.**

JOSEPH BOOTH BROS., LTD.,
RODLEY, LEEDS.
See next week.

LIFTING MACHINERY.

THOS. W. WARD,
ALBION WORKS,
SHEFFIELD.
See Page 17.

MACHINE TOOLS.

THE SHANNON, LTD.,
Ropemaker St., London, E.C.
See Page 67.

OFFICE APPLIANCES.

Have you seen our Advertisement on page ~~69~~ 47 ? A glance at it may save you £500 per annum.—
ED. BENNIS & CO., Ltd., BOLTON.

PAGE & ROWLINGSON,

Chartered Patent Agents.

Mr. Page, who is a Whitworth Exhibitioner and an Associate Member of the Institute of Civil Engineers, has had a large experience as a Practical Mechanical Engineer, and is specially qualified to deal with the most intricate mechanical problems successfully. *Write for Handbook of Information Free.*

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DEPRECIATION OF FACTORIES, Mines, and Industrial Undertakings, and their Valuation. With Tables and Examples.

By EWING MATHESON, M.Inst.C.E.

The Principles which should guide the Writing off for wear and tear, Obsolete plant; Terminable or wasting properties; Effect on Income-tax; Value defined as for Compulsory purchase; Going concern, or dismantled; Rateable value, rental value.

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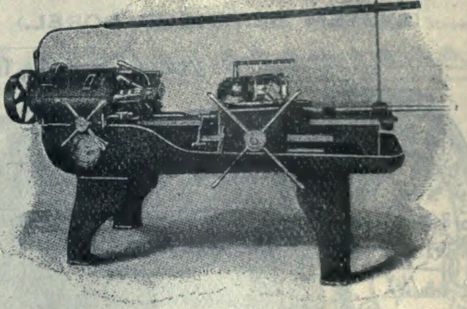

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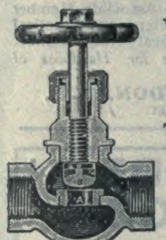
97, Queen Victoria Street, LONDON.

PAGE'S WEEKLY Miscellaneous



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With Renewable Seats, Interchangeable Concentric Valve, Compound Packing to Spindle, Special Metal, and High-Class Workmanship.

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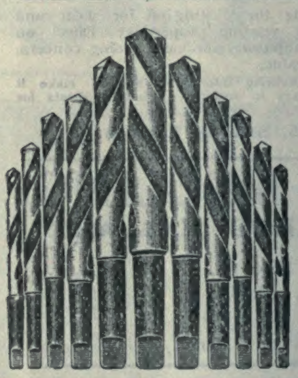

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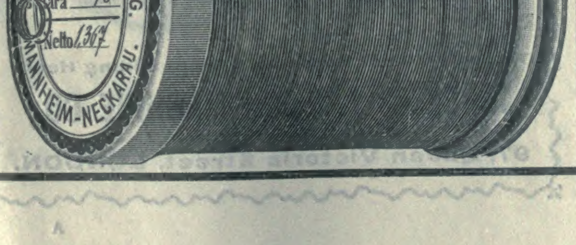
Contractors to the Imperial German Postal Authorities.



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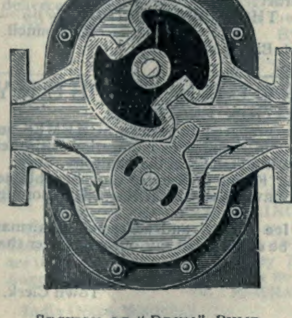

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Ventilating Engineers,

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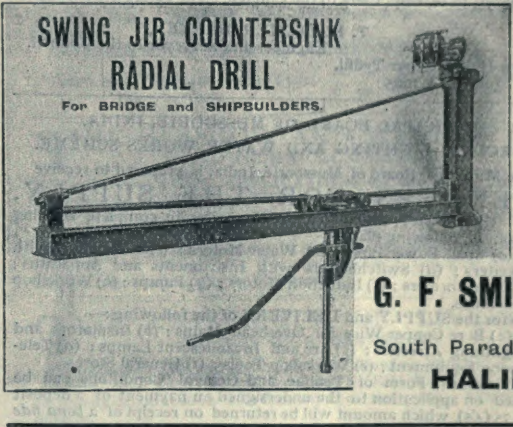

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PAGE'S WEEKLY Contracts

CONTRACTS.

MERTHYR TYDFIL URBAN DISTRICT COUNCIL.

REFUSE DESTRUCTOR PLANT.

The Council invite **TENDERS** from experienced makers of Refuse Destructor Plant for the **ERECTION** of **PLANT** capable of effectually burning 120 tons of refuse per day, together with all buildings and contingent works connected therewith.

The Council have selected three alternative sites, and copies of the site plans, together with "General Conditions and Particulars for the guidance of Contractors tendering," may be obtained upon application to T. FLETCHER HARVEY, Esq., Engineer and Surveyor to the Council, upon payment of a fee of £3 3s., which will be returned upon receipt of a *bona fide* Tender.

The Council do not bind themselves to accept the lowest or any Tender.

Sealed Tenders, endorsed "Destructor Plant," must be delivered to T. Aneuryn Rees, Esq., Clerk to the Council, on or before September 1st, 1905.

T. FLETCHER HARVEY,
Engineer and Surveyor to the Council.
Town Hall, Merthyr Tydfil,
June 16th, 1905.

MUNICIPAL BOARD OF MUSSOORIE, INDIA.

ELECTRIC LIGHTING AND WATER WORKS SCHEME.

The Municipal Board of Mussoorie, India, is prepared to receive

TENDERS FOR THE SUPPLY,

DELIVERY, and **ERECTION** at sites, in complete working order, of the following plant:—

(*a*) Steel Power Pipes; (*b*) Water Motors; (*c*) Alternators with Exciters; (*d*) Switchboards with Instruments and Apparatus; (*e*) Transformers; (*f*) Induction Motors; (*g*) Pumps; (*h*) Workshop Machines.

Also for the **SUPPLY** and **DELIVERY** of the following:—

(*a*) Bare Copper Wire for Overhead Mains; (*b*) Insulators and Lightning Arresters; (*c*) Arc and Incandescent Lamps; (*d*) Telephone Equipment; (*e*) Workshop Tools; (*f*) General Stores.

Specifications, Form of Tender, and General Conditions can be obtained on application to the undersigned on payment of a deposit of Rs. 75 (£5), which amount will be returned on receipt of a *bona fide* Tender. Additional copies may be obtained on payment of a further fee of Rs. 5 (6s. 8d.) per set, which will not be returned.

The Firm whose Tender is accepted will be required to find two sureties to the satisfaction of the Municipality, and to enter with them into a contract to be prepared by the Municipality, and to contain such clauses as it may think necessary.

Sealed Tenders, on the prescribed form, endorsed "Tender for Electric Lighting and Water Works Scheme," should be addressed to the Chairman, Municipal Board, Mussoorie, India, and must be delivered to him on or before Monday, October 23rd, 1905.

The Municipality does not bind itself to accept the lowest or any Tender, nor will it consider any Tender that is not for the whole of the Plant and Material.

By order,
C. H. SHANAN,
Assoc. M.Inst.C.E., A.M.I.E.E., A.M.I.Mech.E.,
Municipal Electrical Engineer.
Municipal Office, Mussoorie, U.P., India,
June 14th, 1905.
Telegraphic Address: "Shanan, Mussoorie."

COUNTY BOROUGH OF WOLVERHAMPTON.

TETTENHALL PUMPING STATION EXTENSIONS.

CONTRACT No. 2.

The Corporation of Wolverhampton are prepared to receive **TENDERS** for a **VERTICAL TRIPLE-EXPANSION PUMPING ENGINE** and **OTHER WORK** connected therewith from engine builders who will undertake to pay the rate of wages and observe the hours of labour recognised and agreed upon between the Trades Unions and the Employers respectively in the locality in which the work is to be performed, or such a rate of wages or hours as are equivalent or approximate thereto.

A copy of the Specification and Form of Tender may be obtained from Mr. E. A. B. WOODWARD, Waterworks Engineer, Town Hall, Wolverhampton, upon payment of the sum of Five Pounds, which amount will be returned to every engine builder who submits a *bona fide* Tender, but not otherwise.

Each Tender must be enclosed in a sealed cover addressed to "The Chairman of the Water Committee," and endorsed "Pumping Machinery," and delivered at my office on or before Friday, the 1st day of September next.

The right to decline the lowest or any Tender is reserved to the Corporation.

HORATIO BREVITT,
Town Clerk.
Town Hall, Wolverhampton,
July 4th, 1905.

BISHOP'S STORTFORD URBAN DISTRICT COUNCIL.

AMENDED ADVERTISEMENT.

SEWAGE WORKS.—CONTRACT No. 1.

Subject to the sanction of the Local Government Board being obtained to the necessary loans, the Council invite **TENDERS** for:—

Supplying and Fixing Gas Pumping Engine, Suction Gas Plant and Sewage Pumps at their Sewage Pumping Station.

Specification and Form of Tender can be obtained on application to the undersigned.

The person or firm whose Tender is accepted will be required to enter into a written contract, and to provide two eligible sureties.

Sealed Tenders, endorsed "Tender for Pumping Engine," to be sent to me, the undersigned, by 4 o'clock p.m. on Tuesday, September 12th, 1905.

The Council do not bind themselves to accept any Tender.

By order,
THOS. SWATHERIDGE,
Clerk to the Council.
Council Offices, 7, North Street, Bishop's Stortford,
July 21st, 1905.

COUNTY BOROUGH OF BURY.

TO REFRIGERATION ENGINEERS.

The Corporation of Bury are prepared to receive **SCHEMES** and **TENDERS** for the **ALTERATIONS** required in connection with their **ICE-MAKING PLANT** and **COLD STORES** at the Abattoirs, Bury.

Conditions, Specifications, and Forms of Tender may be obtained from Mr. ARTHUR W. BRADLEY, Assoc.Mem.Inst.C.E., Borough Engineer and Surveyor.

Sealed Tenders, endorsed "Ice Plant," and addressed Chairman, Abattoirs Sub-Committee, must be delivered at my office not later than the 19th day of August next.

JOHN HASLAM,
Town Clerk.
Municipal Offices,
Bank Street, Bury,
July 6th, 1905.

SELBY URBAN DISTRICT COUNCIL.

NEW WATERWORKS.

PUMPING MACHINERY.—CONTRACT No. 6.

TENDERS are hereby invited for the **CONSTRUCTION, DELIVERY**, and **ERECTION** of **DUPLICATE PUMPING MACHINERY** in connection with the above works, comprising Boilers, Triple-expansion Engines, Surface Condensers, Force Pumps, Head Gear, and Borehole Pumps, with a capacity equal to raising 32,000 gallons per hour under a head of 310 ft.

Copies of the Plans and Specifications will be supplied on application to the Engineers, Mr. PERCY GRIFFITH, M.Inst.C.E., 54, Parliament Street, Westminster, S.W., and Mr. BRUCE MCGREGOR GREY, Assoc. M.Inst.C.E., Council Offices, Selby, Yorkshire, on payment of £5, which will be returned to all contractors who shall submit a *bona fide* Tender for the work on or before the 28th day of August, 1905.

Tenders must be made on the form provided, and delivered under seal to the undersigned by the date above named.

Every Tender must state the periods required respectively for the delivery and the erection of the machinery, also the guaranteed duty of the engines.

The Council do not bind themselves to accept the lowest or any Tender.

By order of the Council,
(Signed) J. H. BANTOFT,
Clerk to the Urban District Council.
Council Offices, Selby, dated the 25th of July, 1905.

MUNICIPAL BOARD OF MUSSOORIE, INDIA.

WATER WORKS SCHEME.

The Municipal Board of Mussoorie, India, is prepared to receive

TENDERS FOR THE SUPPLY AND

DELIVERY of the following:—

(*a*) Pipes; (*b*) Tees; (*c*) Cross Pieces; (*d*) Reducers; (*e*) Bends; (*f*) Bends and Collars; (*g*) Sluice Valves and Stop Cocks; (*h*) Ball and Non-return Valves.

Specifications and Form of Tender can be obtained on application to the undersigned, on payment of a deposit of Rs. 45 (£3), which amount will be returned on receipt of a *bonâ fide* Tender. Additional copies may be obtained on payment of a further fee of Rs. 3 (4s.) each, which will not be returned.

The firm whose Tender is accepted will be required to deposit the sum of Rs. 1500 (£100) in a bank, and the receipt, endorsed in favour of the Chairman, must be forwarded with the Tender. This amount will be forfeited on the failure of the Tenderer to execute a formal contract bond within two months of the acceptance of his Tender.

Sealed Tenders, on the prescribed form, endorsed "Tender for Water Works Scheme," should be addressed to the Chairman, Municipal Board, Mussoorie, India, and must be delivered to him on or before Monday, October 9th, 1905.

The Municipality does not bind itself to accept the lowest or any Tender.

By order,
C. H. SHANAN,
Assoc.M.Inst.C.E., A.M.I.E.E., A.M.I.Mech.E.,
Municipal Electrical Engineer.
Municipal Office, Mussoorie, U.P., India,
June 14th, 1905.
Telegraphic Address: "Shanan, Mussoorie."

PAGE'S WEEKLY Contracts and Appointments Open

COUNTY BOROUGH OF SOUTHAMPTON.

TO ENGINEERS AND OTHERS.

The CORPORATION invite TENDERS for SUPPLYING and FIXING at the Corporation Wharf, Chapel, three 18-in. HIGH-PRESSURE DIRECT-ACTING CENTRIFUGAL PUMPING ENGINES, including all Suction and Delivery Pipes, Steam and other connections.

Particulars may be obtained upon application to Mr. J. A. CROWTHER, A.M.Inst.C.E., Borough Engineer, Market Chambers, 123, High Street, Southampton.

Sealed Tenders, endorsed "Tender for Pumping Engines," must be delivered at my office before 2 p.m. on Monday, the 4th September next.

No pledge is given to accept the lowest or any Tender.

By order,
R. R. LINTHORNE,
Town Clerk.

Town Clerk's Office, Municipal Offices, Southampton,
July 21st, 1905.

THE SECRETARY OF STATE FOR

INDIA in Council is prepared to receive TENDERS from such persons as may be willing to supply :—

1. ROLLED MATERIAL FOR WAGONS.
2. ELECTRIC TRAVELLING CRANES (40 tons).

The Conditions of Contract may be obtained on application to the Director-General of Stores, India Office, Whitehall, S.W., and Tenders are to be delivered at that office by Two o'clock p.m. on Wednesday, August 9th, 1905, after which time no Tender will be received.

E. GRANT BURLS,
Director-General of Stores.

India Office, Whitehall.
July 26th, 1905.

FLEETWOOD SEWERAGE WORKS, 1905.

CONTRACT No. 2.

The Fleetwood Urban District Council are prepared to receive TENDERS from competent persons for the SUPPLY and ERECTION of town's GAS ENGINES and VERTICAL TREBLE-RAM PUMPS, in duplicate, capable of delivering 260 cubic feet of sewage per minute through a total lift of 27½ ft., including friction. Also for the SUPPLY and ERECTION of town's GAS ENGINES and CENTRIFUGAL PUMPS, in duplicate, capable of delivering 620 cubic feet of sewage per minute, through a total lift of 21½ ft., together with Starting Apparatus, Water Tank, Travelling Crane, Workshop Fittings, and other appliances and connections.

The Council are further prepared to receive, as alternative to the above-described machinery, TENDERS for the SUPPLY and ERECTION of PRODUCER GAS PLANT, PRODUCER GAS ENGINES, VERTICAL TREBLE-RAM PUMPS and CENTRIFUGAL PUMPS, all in duplicate, capable of performing the aforesaid duties, together with all the appurtenances above referred to.

Plans and sections of the proposed works may be seen, and specifications and bills of particulars, together with forms of Tender, may be obtained on application to GEO. R. STRACHAN, Esq., M.Inst.C.E., 9, Victoria Street, Westminster, London, on and after Monday, 24th inst., on payment of a deposit of Three Guineas by cheque, which will be returned on receipt of a *bonâ fide* Tender.

Sealed Tenders, endorsed "Tender for Sewage-Pumping Machinery," are to be delivered to me at my office in Fleetwood at or before 10 o'clock a.m. on Thursday, August 10th, 1905.

The lowest or any Tender will not necessarily be accepted.

By order,
JOSEPH TILDESLEY,
Clerk and Accountant.

Town Hall, Fleetwood,
July 19th, 1905.

BOROUGH OF DROITWICH.

The BOROUGH COUNCIL of Droitwich invite TENDERS for :—

No. 1. The Supply and Delivery of 633 yards of Three-inch Cast-Iron Water-Mains, and 318 yards of Four-inch ditto, together with Specials and Sundry Castings.

No. 2. For the Hauling, Excavating, Laying, and Jointing of 633 yards Three-inch and 318 yards four-inch Water-Mains and Specials, together with the fixing of Valves, and Hydrants, and Construction of Brickwork Chambers for same.

Plans, Specifications, and Detail Drawings may be seen, and Specification, with Schedule of Quantities and Form of Tender for No. 1 Contract, and Schedule of Quantities with Form of Tender for No. 2 Contract, may be obtained on and after the 28th inst., on application to Mr. HY. HULSE, Borough Surveyor, Droitwich, on payment of One Guinea for each Contract, which will be returned on receipt of a *bonâ fide* Tender.

Sealed Tenders, on the Council's form, to be endorsed "Water-Mains—Contract No. 1," or "Contract No. 2," as the case may be, and to be delivered to the undersigned not later than 10 a.m. on August 11th, 1905.

S. J. TOMBS,
Town Clerk.

Town Hall, Droitwich,
July 20th, 1905.

APPOINTMENTS OPEN.

CITY AND COUNTY OF NEWCASTLE-UPON-TYNE.

APPOINTMENT OF CITY ENGINEER AND TOWN SURVEYOR.

The CORPORATION of Newcastle-upon-Tyne are prepared to receive applications for the appointment of CITY ENGINEER and TOWN SURVEYOR. The gentleman appointed will be required to devote the whole of his time to the duties of his office, and not to undertake, or engage in, any other employment. Salary, £800 per annum, rising £100 per annum to £1,000 per annum. Duties to commence on November 11th, 1905, or such subsequent date as may be arranged.

Candidates for the appointment are requested to send their applications, stating their age (which must not exceed fifty years), qualifications, and experience, and enclosing copies of not exceeding three testimonials of recent date, addressed "Town Clerk, Town Hall, Newcastle-upon-Tyne," and endorsed "Appointment of City Engineer," not later than August 5th, 1905, after which no application will be received.

Canvassing will be considered a disqualification.

HILL MOTUM,
Town Clerk.

Town Hall, Newcastle-upon-Tyne,
July 7th, 1905.

THE GLASGOW AND WEST OF SCOTLAND TECHNICAL COLLEGE.

The Governors invite APPLICATIONS for the PROFESSORSHIP in the DEPARTMENT of ENGINEERING in this College, vacant by the appointment of Professor Watkinson to the Chair of Engineering in the University of Liverpool. Salary £500.

Applications, with testimonials, must be sent not later than August 21st, to the SECRETARY, Technical College, Glasgow, from whom further information may be obtained.

THE UNIVERSITY OF LIVERPOOL.

FACULTY OF ENGINEERING.

APPLICATIONS are invited for the following POSTS :—

ASSISTANT LECTURER in ENGINEERING, whose duties will be chiefly in connection with the subject of Surveying. Salary £200 per annum.

ASSISTANT LECTURER and DEMONSTRATOR in ENGINEERING. Salary, £100 per annum.

Applications to be sent to the Registrar (from whom further particulars may be obtained) not later than August 14th.

Duties to commence on October 2nd, 1905.

P. HEBBLETHWAITE,
Registrar.

BURMA RAILWAYS COMPANY, LIMITED.

ASSISTANT ENGINEERS.

The Directors are prepared to receive

APPLICATIONS (BY LETTER ONLY) for three APPOINTMENTS as TEMPORARY ASSISTANT ENGINEERS in the Way and Works Department in Burma.

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Terms : Two years' agreement, with three months' notice, and free first-class passage to Burma. The Company will also provide the selected candidates with first-class passages back to England on the termination of their services, unless such service shall be terminated for misconduct.

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Letters of application, marked "Assistant Engineer," with copies (not originals) of testimonials, accompanied by a medical certificate of fitness for residence in India, should be addressed to the undersigned not later than August 10th, 1905.

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(Signed) A. G. BEGBIE,
Managing Director.

Office,
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July 19th, 1905.

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NOTE.—The display advertisements of the firms mentioned under each heading can be found readily by reference to the Alphabetical Index to Advertisers on pages 35, 37, 38, and 40.

In order to assure fair treatment to advertisers, each firm is indexed under its leading speciality ONLY.

Advertisers who prefer, however, to be entered under two or more different sections can do so by an annual payment of 5s. for each additional section.

Advertisers' Service Bureau.
British Advertiser Service Bureau, Queen Anne's Chambers, Westminster, S.W.

Artesian Well Machinery.
John Z. Thom, Patricroft, Manchester.

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Binney & Son, Catherine Street, City Road, London, E.C.
Cort, Arthur, & Co., Camberwell, London, S.E.
Fleming, Birkby & Goodall, Ltd., West Grove, Halifax.
Gilmour, W. & O., St. John's Hill, Edinburgh.

Boilers.
Clayton, Son & Co., Ltd., Leeds City Boiler Works, Leeds.
Grantham Crank & Iron Co., Ltd., Grantham.

Boilers (Water-tube).
Babcock & Wilcox, Ltd., Oriel House, Farringdon Street, London, E.C.
Stirling Boiler Co., Ltd., Motherwell, N.B.

Bolts, Nuts, Rivets, etc.
Herbert W. Periam, Ltd., Floodgate Street Works, Birmingham.
T. D. Robinson & Co., Ltd., Derby.

Books.
Crosby Lockwood & Son, Stationers' Hall Court, London, E.C.
Griffin, Charles, & Co., Exeter Street, Strand, W.C.
New Zealand Mines Record, Wellington, New Zealand.
Spon, E. & F. N., 125, Strand, W.C.

Boring Machines.
Asquith, William, Ltd., Well Road Works, Halifax.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.

Case-Hardening Compounds.
Hy. Miller & Co., Millgarth Works, Leeds.

Castings.
Ashmore, Benson, Pease & Co., Ltd., Stockton-on-Tees.

Catalogues, Printing, &c.
Atlantic Press, Ltd., Weymouth Street, Manchester.
Spottiswoode Advertising Agency, Clun House, Surrey Street, Strand, W.C.
Stafford, Arthur, & Co., Denton, Manchester.

Chucks.
Fairbanks Co., 78-80, City Road, London, E.C.

Cisterns, Tanks, &c.
Ashmore, Benson, Pease & Co., Ltd., Stockton-on-Tees.
F. A. Keep, Juxon & Co., Barn Street, Birmingham.

Clutches (Friction).
David Bridge & Co., Castleton Ironworks, Rochdale, Lancashire.

Colliery Plants.
Graham, Morton & Co., Ltd., Leeds.

Condensing Plant.
Benn, Sykes, Haslingden, near Manchester.
Concentric Condenser, Ltd., 23, Northumberland Avenue, London, W.C.
Mirrlees-Watson & Co., Ltd., Glasgow.

Consulting Engineers.
Gibbs, John, & Son, 80, Juke Street, Liverpool.
G. H. Hughes, A.M.I.M.E., 97, Queen Victoria Street, London, E.C.
Melville & Macalpine, 615, Walnut Street, Philadelphia, Pa., U.S.A.

Continental Railway Arrangements.
Northern Railway of France.
South Eastern & Chatham Railway Co.

Conveying and Elevating Machinery.
Adolf Bleichert & Co., Leipzig-Gohlis, Germany.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
Graham, Morton & Co., Ltd., Leeds.
Temperley Transporter Co., 72, Bishopsgate Street Within, London, E.C.

Coverings (Boiler).
Magnesia Coverings, Ltd., Washington Station, co. Durham.

Cranes, Travellers, Winches, etc.
Joseph Booth & Bros. Ltd, Rodley, Leeds.
Thomas Broadbent & Sons, Ltd., Huddersfield.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.

Cranks.
Clarke's Crank & Forge Co., Ltd., Lincoln, England.

Cutters (Milling).
Pratt & Whitney Co., 23-25, Victoria Street, London, S.W.
E. G. Wrigley & Co., Ltd., Foundry Lane Works, Soho, Birmingham.

Destructors.
Heenan & Froude, 4, Chapel Walks, Manchester.
Horsfall Destructor Co., Ltd., Armley, Leeds.

Dredges and Excavators.
Delange & Cie. Mce., Hoboken, near Antwerp.
Rose, Downs & Thompson, Ltd., Old Foundry, Hull.

Drilling Machines.
Asquith, William, Ltd., Well Road Works, Halifax.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Swift, George, Claremont Ironworks, Halifax.

Economisers.
E. Green & Son, Ltd., Manchester.

Ejectors (Pneumatic).
Hughes & Lancaster, 47, Victoria Street, London, S.W.

Electrical Apparatus.
Allgemeine Elektricitäts Gesellschaft, Berlin, Germany.
Broadbent, T. W., Victoria Electrical Works, Huddersfield.
Crypto Electrical Co., 3, Tyer's Gateway, Bermondsey Street, London, S.E.
Gent & Co., Ltd., Faraday Works, Leicester.
Greenwood & Batley, Ltd., Albion Works, Leeds.
India Rubber, Gutta Percha, and Telegraph Works Co., Ltd., Silvertown, London, E.
Mather & Platt, Ltd., Salford Iron Works, Manchester.
Matthews & Yates, Ltd., Swinton, Manchester.
Mix and Genest, Berlin, W., Germany.
Nalder Bros. & Thompson, 34, Queen Street, London, E.C.
New Gutta Percha Co., Ltd., Dashwood House, New Broad Street E.C.
Newton Brothers, Full Street, Derby.
Phœnix Dynamo Manufacturing Co., Bradford, Yorks.
Sturtevant Engineering Co., Ltd., 147, Queen Victoria Street, London, E.C.
Turner, Atherton & Co., Ltd., Denton, Manchester.
B. Weaver & Co., 22, Rosoman Street, Clerkenwell, London, E.C.

Engineers' Supplies.
Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.

Engines (Gas).
Campbell Gas Engine Co., Ltd., Halifax
Soest, L., & Co., Ltd., 114-116, Victoria Street, London, S.W.

Engines (Electric Lighting).
McLaren, J. and H., Midland Engine Works, Leeds.

Engines (Locomotive).
Baldwin Locomotive Works, Philadelphia, Pa., U.S.A.
Hunslet Engine Co., Ltd., Leeds, England.
Hudswell, Clarke & Co., Ltd., Leeds, England.
McLaren, J. & H., Midland Engine Works, Leeds.

Engines (Portable).
Garrett, R., & Sons, Leiston, R.S.O., Suffolk.

Engines (Stationary).
Allis-Chalmers Co., 533, Salisbury House, Finsbury Circus, London, E.C.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
Garrett, R., & Sons, Leiston, R.S.O., Suffolk.
Mirrlees Watson Co., Ltd., Glasgow.

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Jno. Fowler & Co. (Leeds), Ltd., Steam Plough Works, Leeds.
Garrett & Sons, Ltd., Richard, Leiston, R.S.O., Suffolk.

Engravers.
Jno. Swain & Son, Ltd., 58, Farringdon Street, London, E.C.

Exhaust Steam Oil Separators.
Lancaster & Tonge, Ltd., Pendleton, Manchester.

Fans, Blowers.
Capel Fan Co., 13, Moseley Street, Newcastle-on-Tyne.
Davidson & Co., Ltd., "Sirocco" Engineering Works, Belfast, Ireland.
Gibbs, John & Son, 80, Juke Street, Liverpool.
James Keith & Blackman Co., Ltd., 27, Farringdon Avenue, London, E.C.
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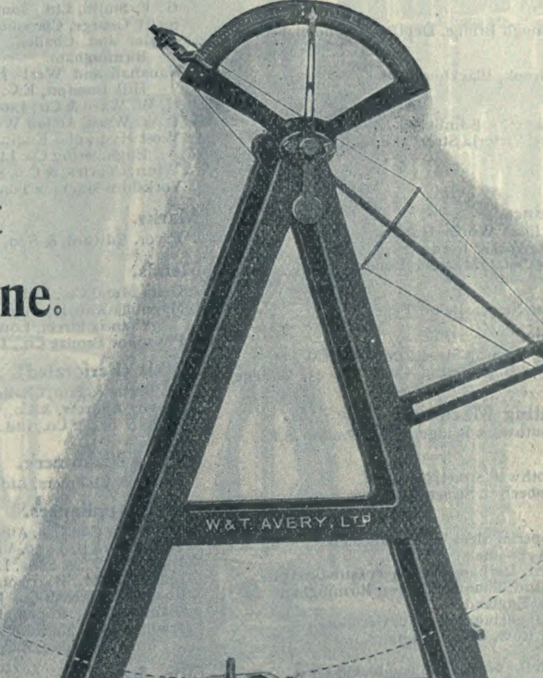

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M. Glover & Co., Patentees and Saw Mill Engineers, Leeds.

Fountain Pens.
Mabie, Todd & Bard, 93, Cheapside, London, E.C.

Forging (Drop) Plants.
Brett's Patent Lifter Co., Ltd., Coventry.

Forgings (Drop).
J. H. Williams & Co., Brooklyn, New York, U.S.A.

Furnaces.
Deighton's Patent Flue & Tube Company, Vulcan Works, Pepper Road, Leeds.
Leeds Forge Co., Ltd., Leeds.
Masons Gas Power Co., Ltd., Alma Works, Levenshulme, Manchester.

Gas Producers.
Graham, Morton & Co., Ltd., Leeds.
Masons Gas Power Co., Ltd., Alma Works, Levenshulme, Manchester.

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J. B. Treasure & Co., Vauxhall Road, Liverpool.
Tomey, J., & Sons, Aston, Birmingham.

Gauges (Pressure, Vacuum, and Hydraulic).
Dobbie, McInnes, Ltd., 45, Bothwell Street, Glasgow.

Gearing.
Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.
Asquith, William, Ltd., Well Road Works, Halifax.
Reid Gear Co., Linwood, near Glasgow.
Wild, M. B., & Co., Corporation Street, Birmingham.

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Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.

Greases.
Blumann and Stern, Ltd., Plough Bridge, Deptford, London, S.E.

Hack Saws.
Baynes, Charles, Knuzden Brook, Blackburn.

Hammers (Steam).
Davis & Primrose, Leith Ironworks, Edinburgh.
Niles-Bement Pond Co., 23-25, Victoria Street, London, S.W.

Hoisting Machinery.
See Conveying Machinery.

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Asquith, William, Ltd., Well Road Works, Halifax.
Greenwood & Batley, Albion Works, Leeds.
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Hydraulic Leather.
Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.

Hydraulic Machine Tools.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Vauxhall and West Hydraulic Engineering Co. Ltd., 23, College Hill, London, E.C.

Icemaking and Refrigerating Machinery.
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Indicators.
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Hannan & Buchanan, 75, Robertson Street, Glasgow.

Iron and Steel.
Allen, Edgar, & Co. Ltd., Imperial Steel Works, Sheffield.
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Consett Iron Co., Ltd., Consett, Durham, and Newcastle-on-Tyne.
Fairley & Sons, James, Old Mint, Shadwell Street, Birmingham.
Farnley Iron Co., Ltd., Leeds. England.
Fried. Krupp, Grusonwerk, Magdeburg-Buckau, Germany.
J. Frederick Melling, 14, Park Row, Leeds, England.
Parker Foundry Co., Derby.
Purden, John & Sons, Lambhill Forge, by Maryhill, Glasgow.
Walter Scott, Ltd., Leeds Steel Works, Leeds, England.
Gilbert Thompson & Co., 116, Victoria Street, London, S.W.

Ironwork (Constructional).
F. A. Keep, Juxon & Co., Barn Street, Birmingham.

Ironwork (Galvanised).
F. A. Keep, Juxon & Co., Barn Street, Birmingham.

Lagging Sheets.
Zeitz & Co., 21, Lime Street, London, E.C.

Lathes.
Asquith, William, Ltd., Well Road Works, Halifax.
Bradbury & Co., Ltd., Wellington Works, Oldham.
Eclipse Tool Manufacturing Co., Linwood, near Glasgow.
Leckenby, Benton, & Co., Perseverance Ironworks, Halifax.
Mitchell, D., & Co., Ltd., Central Ironworks, Lawkholme, Keighley.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Northern Engineering Co. (1900) Ltd., King Cross, near Halifax.
Swift, George, Claremont Ironworks, Halifax.

Lathe Carriers.
Williams, J. H., & Co., Brooklyn New York, U.S.A.

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Waygood & Co., Ltd., Falmouth Road, London, S.E.

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Blumann & Stern, Ltd., Plough Bridge, Deptford, London, S.E.
Reliance Lubricating Oil Co., The, 19 & 20, Water Lane, Great Tower Street, London, E.C.
Matthew Wells & Co., Hardman Street Oil Works, Manchester.

Machine Tools.
Asquith, William, Ltd., Well Road Works, Halifax.
George Addy & Co., Waverley Works, Sheffield.
Bateman's Machine Tool Co., Hunslet, Leeds.
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Bradbury & Co., Ltd., Wellington Works, Oldham.
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Greenwood & Batley, Ltd., Leeds.
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Luke & Spencer, Ltd., Broadheath, Manchester.
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Jos. C. Nicholson Tool Co., City Rd. Tool Wks., Newcastle-on-Tyne.
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Noble & Lund Ltd., Felling-on-Tyne.
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C. Redman & Sons, Halifax.
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G. F. Smith, Ltd., South Parade, Halifax.
Swift, George, Claremont Ironworks, Halifax.
Taylor and Challen, Ltd., Derwent Foundry, Constitution Hill, Birmingham.
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H. W. Ward & Co., Lionel Street, Birmingham.
T. W. Ward, Albion Works, Sheffield.
West Hydraulic Engineering Co. (see Vauxhall and West Hydraulic Engineering Co. Ltd.), 23, College Hill, London, E.C.
Winn, Charles, & Co., St. Thomas Works, Birmingham.
Yorkshire Machine Tool and Engineering Works, Liversedge, Yorks.

Marks.
Pryor, Edward, & Son, 68, West Street, Sheffield.

Metals.
Delta Metal Co., Ltd., East Greenwich, London, S.E.
Magnolia Anti-Friction Metal Co., Ltd., of Great Britain, 49, Queen Victoria Street, London, E.C.
Phosphor Bronze Co., Ltd., Southwark, London, S.E.

Metals (Perforated).
W. Barns & Son, Chalton Street, Euston Road, London, N.W.
Brown, Andrew, & Co., 110, Cannon Street, London, E.C.
Méguin, Fr., & Co., Ltd., Engineering Works, Dillingen-on-Saar.

Mining Machinery.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.

Office Appliances.
Halden & Co., J., 8, Albert Square, Manchester.
Hall & Co., B. J., 39, Victoria Street, London, S.W.
Inglesant, T., & Sons, Ltd., Atlas House, Leicester.
Lyle Co., Ltd., Harrison Street, Gray's Inn Road, London, W.C.
Rockwell-Wabash Co. Ltd., 69, Milton Street, London, E.C.
Shannon, Ltd., Ropemaker Street, London, E.C.
Trading and Manufacturing Co., Ltd., Temple Bar House, Fleet Street, London, E.C.

Oils, &c.
Blumann and Stern, Ltd., Plough Bridge, Deptford, London, S.E.
Valor Co., Ltd., Rocky Lane, Aston Cross, Birmingham.
Wells, M., & Co., Hardman Street Oil Works, Manchester.

Packing.
Beldam Packing & Rubber Co., 93-94, Gracechurch Street, London, E.C.
Frictionless Engine Packing Co., Ltd., Hendham Vale Works, Harpurhey, Manchester.
Lancaster & Tonge, Ltd., Pendleton, Manchester.
Redfern & Co., S., Swan Lane, New Brown Street, Manchester.
Quaker City Rubber Co., Coronation House, Lloyd's Avenue, E.C.
United States Metallic Packing Co., Ltd., Bradford.
J. Bennett von der Heyde, 6, Brown Street, Manchester.

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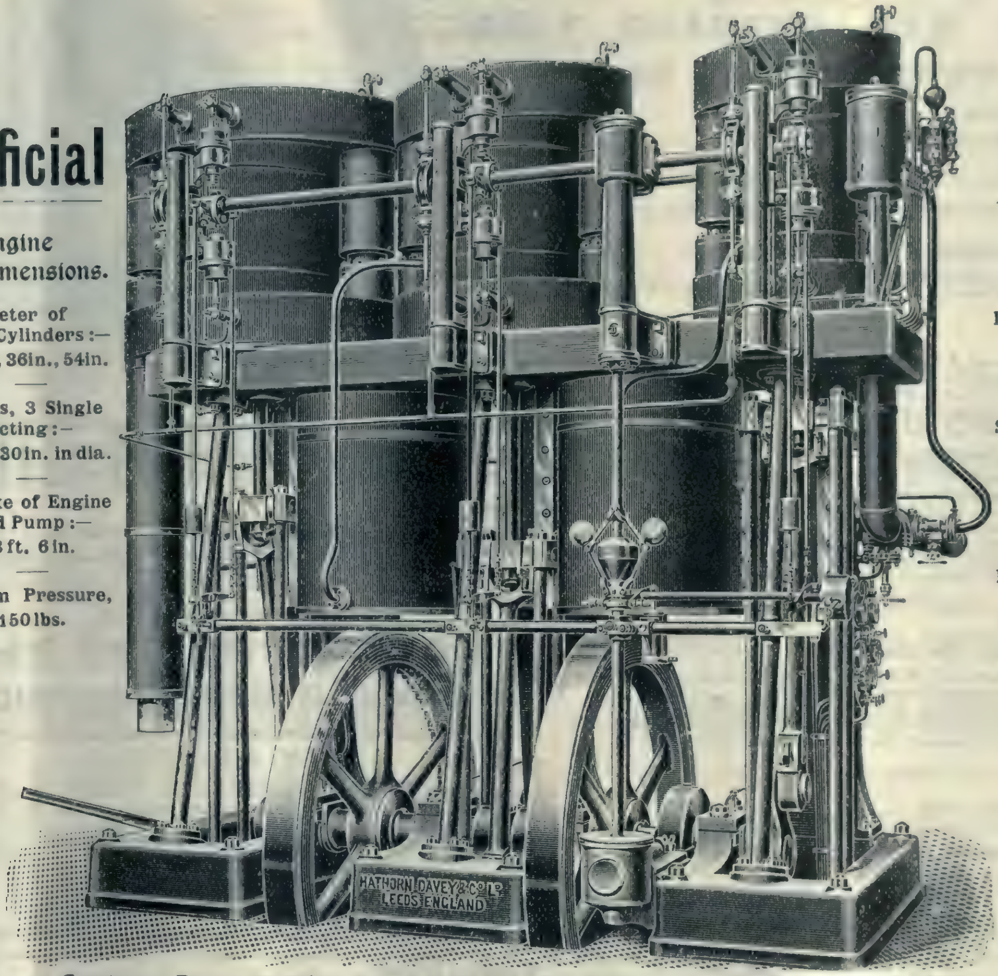

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Photographers.

Booker & Sullivan, 67 and 69, Chancery Lane, W.C.
Elliott & Fry, 55, Baker Street, London, W.

Pinch Bars.

Samson & Co., Garforth, near Leeds.

Pipe Wrenches (Chain).

Williams, J. H., & Co., Brooklyn, New York, U.S.A.

Pistons.

Lancaster & Tonge, Ltd., Pendleton, Manchester.

Planished Sheets.

Zeitz & Co., 21, Lime Street, London, E.C.

Porcelain.

Gustav Richter, Charlottenburg, near Berlin, Germany.

Presses (Hydraulic).

Greenwood & Batley, Albion Works, Leeds.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.

Publishers.

Crosby Lockwood & Son, 7, Stationers' Hall Court, London, E.C.
Charles Griffin & Co., Ltd., Exeter Street, Strand, London, W.C.
Spon, E. and F. N., 125, Strand, W.C.
New Zealand Mines Record, Wellington, New Zealand.

Pumps and Pumping Machinery.

Drum Engineering Co., 27, Charles Street, Bradford.
Enke, Carl, Schkeuditz-Leipzig, Germany.
Fairbanks, Morse & Co., 126, Southwark Street, London, S.E.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
J. P. Hall & Sons, Ltd., Peterborough.
Hathorn, Davey & Co., Ltd., Leeds, England.
Positive Rotary Pumps, Ltd., 23, Northumberland Avenue, London, W.C.
Tangyes, Ltd., Cornwall Works, Birmingham.

Radial Drilling Machines.

Asquith, William, Ltd., Well Road Works, Halifax.
Greenwood & Batley, Albion Works, Leeds.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Northern Engineering Co. (1900), Ltd., King Cross, near Halifax.
Swift, George, Claremont Ironworks, Halifax.

Rails.

Wm. Firth, Ltd. Leeds.

Railway Wagons.

Nye, A. W., 110, Cannon Street, London, E.C.
W. R. Renshaw & Co., Ltd., Phœnix Works, Stoke-on-Trent.

Riveted Work.

F. A. Keep, Juxon & Co., Forward Works, Barn Street, Birmingham.

Roller Bearings.

Hyatt Roller Bearing Co., 47, Victoria Street, London, S.W.

Roofs.

D. Anderson & Son, Ltd., Lagan Felt Works, Belfast.
Graham, Morton & Co., Ltd., Leeds.
Head, Wrightson & Co., Ltd., Thornaby-on-Tees.

Ropeways (Aerial).

Bullivant & Co., Ltd., 72, Mark Lane, London, E.C.

Scientific Instruments.

Cambridge Scientific Instrument Co., Ltd. Cambridge.

Spanners.

Williams, J. H., & Co., Brooklyn, New York, U.S.A.

Stampings.

Thomas Smith & Sons of Saltley, Ltd., Birmingham.
Williams, J. H., & Co., Brooklyn, New York, U.S.A.

Stamps (Rubber).

Rubber Stamp Co., 1 & 2, Holborn Buildings, Broad Street Corner, Birmingham.

Stamps (Metal).

Edward Pryor & Son, 68, West Street, Sheffield.

Steam Traps.

British Steam Specialties, Ltd., Fleet Street, Leicester.
Lancaster & Tonge, Ltd., Pendleton, Manchester.

Steam Wagons.

Thornycroft & Co., Ltd., J. I., Chiswick, London, W.
Yorkshire Patent Steam Wagon Co., Pepper Road, Hunslet, Leeds.

Steel Tools.

Saml. Buckley, St. Paul's Square, Birmingham.
Pratt & Whitney Co., 23-25, Victoria Street, London, S.W.

Steel Structures.

Ashmore, Benson, Pease & Co., Ltd., Stockton-on-Tees.

Stokers.

Ed. Bennis & Co., Ltd., Bolton, Lancs.
Meldrum Brothers, Ltd., Atlantic Works, Manchester.

Stone Breakers.

S. Pegg & Son, Alexander Street, Leicester.

Superheaters.

A. Bolton & Co., 40, Deansgate, Manchester.

Time Recorders.

Howard Bros., 40, Paradise Street, Liverpool, and 100c, Queen Victoria Street, London, E.C.
Recorders, Ltd., 171, Queen Victoria Street, London, E.C.
Warwick's Time Stamp Co., 134, Highbury Hill, London, N.

Tubes.

Premier Boiler Tubes, Ltd., 28, Victoria Street, London, S.W.
Thomas Piggott & Co., Ltd., Spring Hill, Birmingham.
Tubes, Ltd., Birmingham.

Turbines.

Greenwood & Batley, Albion Works, Leeds.
S. Howes, 64, Mark Lane, London, E.C.

Typewriters.

Elliott-Fisher Co., 75, Cannon Street, London, E.C.
Empire Typewriter Co., 77, Queen Victoria Street, London, E.C.
Yost Typewriter Co., 50, Holborn Viaduct, London, E.C.

Valves.

Holmes & Co., W. C., Huddersfield.
Hunt & Mitton, Crown Brass Works, Oozells Street North Birmingham.
Scotch and Irish Oxygen Co., Ltd., Rosehill Works, Glasgow.
Shaw, Joseph, Albert Works, Huddersfield.
Winn, Charles, & Co., St. Thomas Works, Birmingham.

Ventilating Appliances.

Matthews & Yates, Ltd., Swinton, Manchester.

Wagons—Steam.

Thornycroft & Co., J. I., Ltd., Chiswick, London, W.

Weighing Apparatus.

W. & T. Avery, Ltd., Soho Foundry, Birmingham, England.
Samuel Denison & Son, Hunslet Moor, near Leeds.
Graham, Morton & Co., Ltd., Leeds.

Wells Light.

A. C. Wells & Co., 100A, Midland Road, St. Pancras, London, N.W.

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Eric S. A. Smith, Bridlington.

Wire Working Machinery.

Ed. Brand, 35, Shakespeare Street, Manchester.

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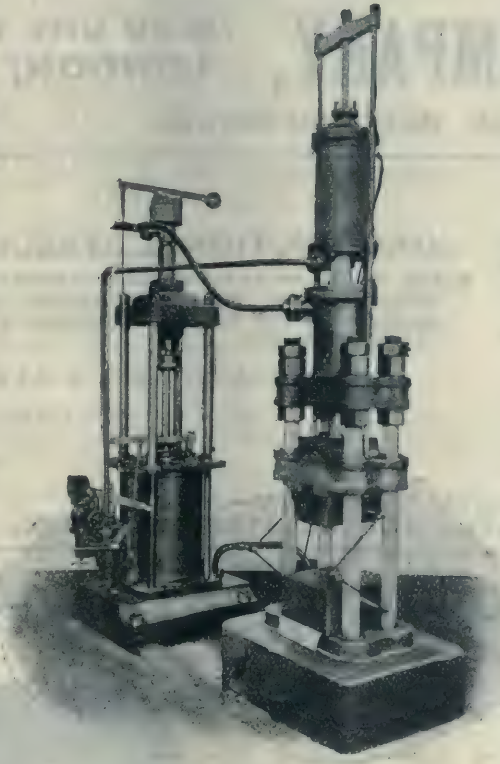

KALK, near Cologne-on-Rhine
(GERMANY).

Department I.

MACHINE TOOLS.

Department II.

AUXILIARY MACHINERY FOR STEEL WORKS, &c.

Department III.

ROLLING MILL PLANTS.

Department IV.

HYDRAULIC MACHINERY.

THE

Vauxhall & West Hydraulic Engineering Co. LTD.

23, COLLEGE HILL, LONDON, E.C.

Contractors for Hydraulic Plant and Testing Machines to the Governments of

GREAT BRITAIN,
INDIA,
GERMANY,
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RUSSIA,
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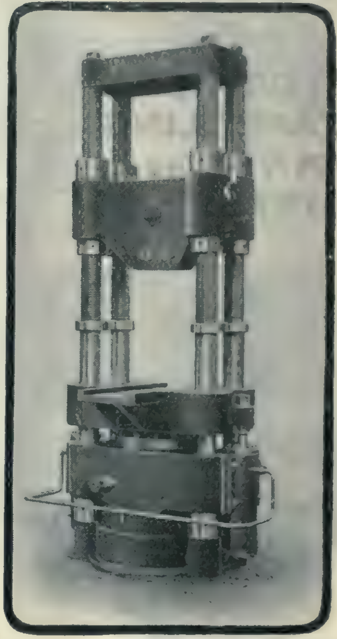
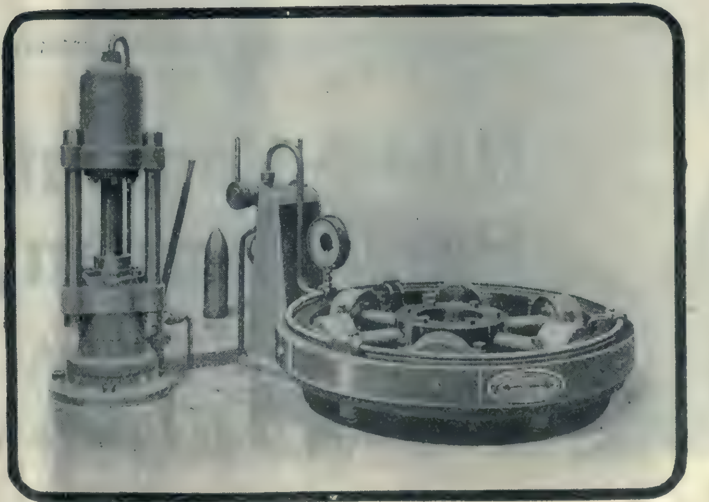
SPAIN,
BELGIUM,
SWITZERLAND,
HOLLAND,
JAPAN,
CHILI,
Crown Agents for the Colonies,
&c., &c.



Shell Press.



Patent Shell-Banding Press.

PAGE'S WEEKLY Machine Tools

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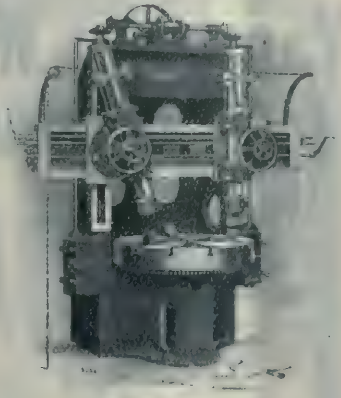
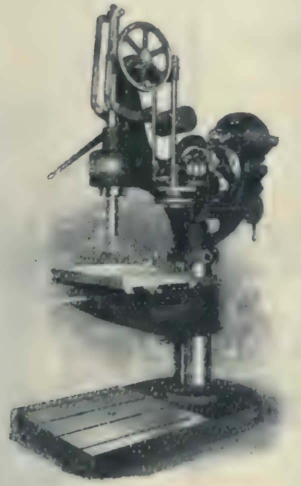
ELECTRIC TRAVELLING CRANES and HOISTS.

3 ton Electric Hoist.

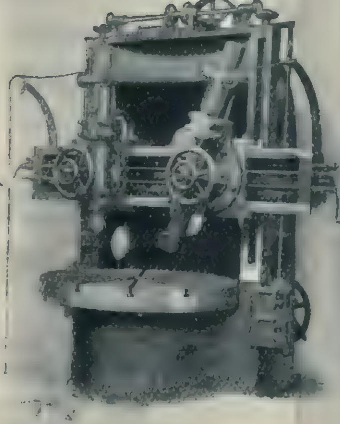


37 in. Boring Mill.

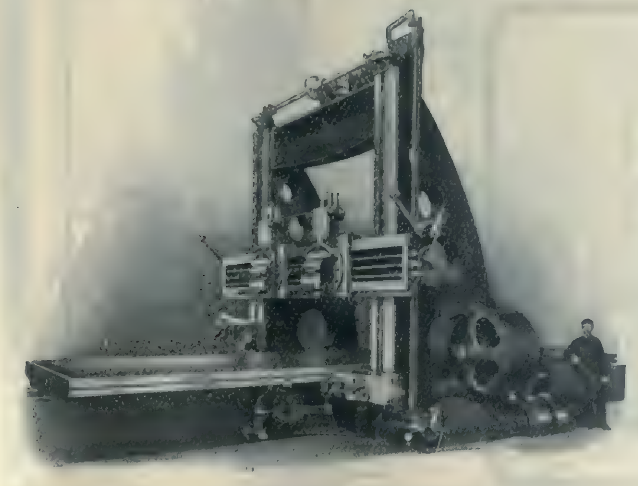
5½ft. Universal Radial Drill.



50 in. Vertical Drill.



51 in. Boring Mill.



10 ft. Planer, Pneumatic Clutches.

Complete Equipment for Locomotive, Machine, and Repair Shop.

Niles-Bement-Pond Company

NEW YORK, U.S.A.

23-25, Victoria Street, London, S.W.

TELEGRAMS:—
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Radial Drilling Machines.

NEW AND IMPROVED DESIGNS. DISPENSING WITH OVERHANGING TOP SHAFT

High-Class Machine Tools.

IN STOCK FOR . . . . IMMEDIATE DELIVERY.

Send for Descriptive Catalogue.

THOS. W. WARD, LTD.,
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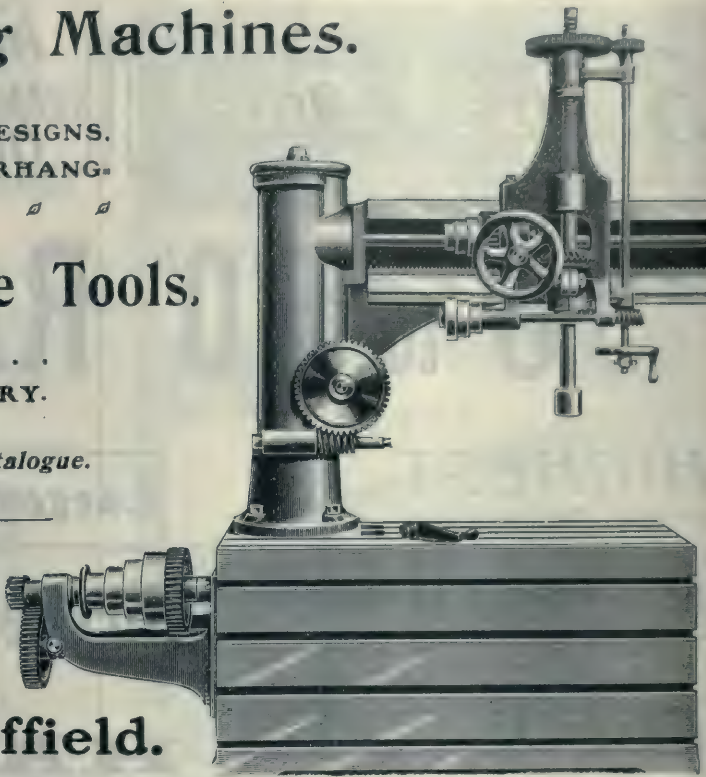

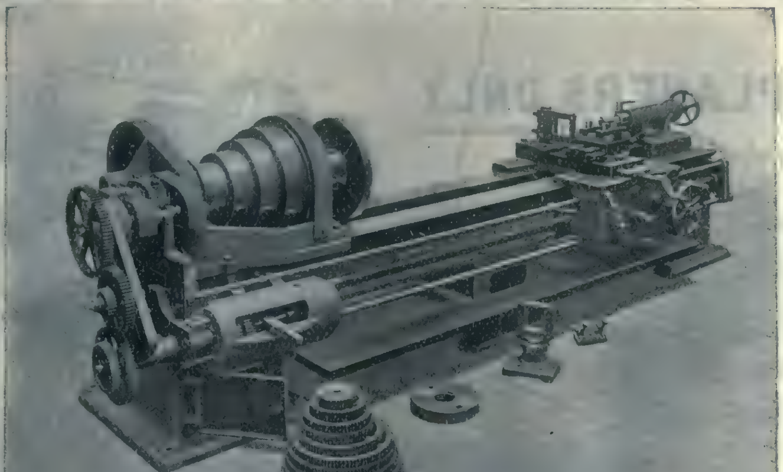

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A Speciality.

"ACCURATE."
"DURABLE."
"POWERFUL."

8½in., 10in., and 12in. Centres.

REASONABLE IN PRICE.
UNEQUALLED IN POWER.

Send us your Inquiries.

NOBLE & LUND, LIMITED,
FELLING-ON-TYNE.

PAGE'S WEEKLY Machine Tools

3 *Styles of Drive*

Belting
Belting and Gearing
Gearing

3'6" to 6'0" RADIALS

HIGHEST
RATE OF
FEEDS . .

Largest English Makers.

Northern Engineering
(1900) Co., Ltd.,
HALIFAX.

BATEMAN'S MACHINE TOOL Co., LTD.,

Makers of . . .

HIGH-SPEED PLANERS ONLY

Address: **Hunslet, LEEDS.**

OUR PATENT MACHINES

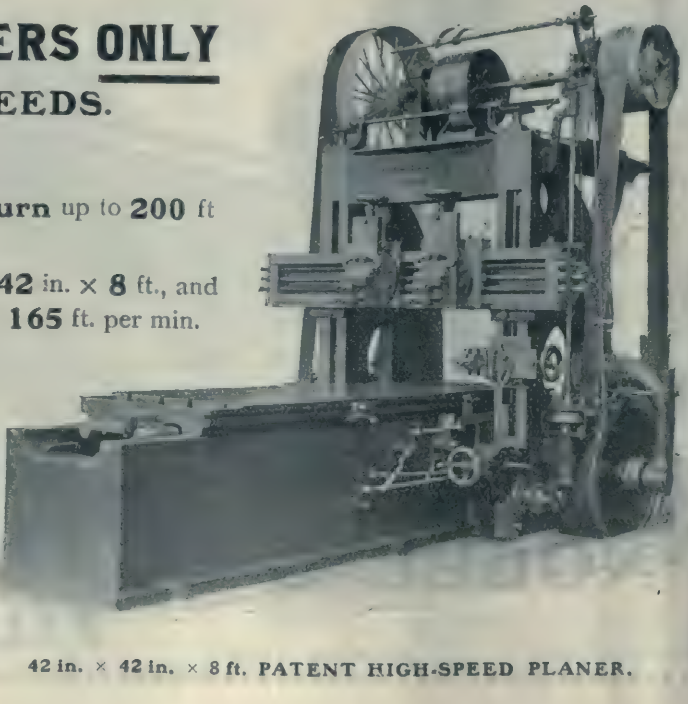
Cut up to **80** ft. per min. and **Return** up to **200** ft per min. according to size.

The Machine illustrated is a **42** in. × **42** in. × **8** ft., and **Cuts** at **60** ft. per min., **Returns** at **165** ft. per min.

With Two Tools at ⅛ in. feed, it will plane **4,032** sq. in. in **30** to **35** mins.

With a cut ⅜ in. deep, at ⅛ in. feed, it will remove nearly **½-TON** of metal per **hour.**

Our **60** in. × **60** in. × **12** ft. Planer **Cuts** at **60** ft. per min., **Returns** at **130** ft. per min.



42 in. × 42 in. × 8 ft. PATENT HIGH-SPEED PLANER.

PAGE'S WEEKLY Machine Tools, &c.

WARD'S No. 2 Vertical Miller

TELEPHONE
No.: 1469.

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24 in. x 9 in. x 15 in.

Contractors to
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Luke and Spencer
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BRITISH MANUFACTURERS
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EMERY AND CORUNDUM
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Telegraphic Address: "Alma, Liversedge."
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**Builders
of
High-Class Machine
Tools.**

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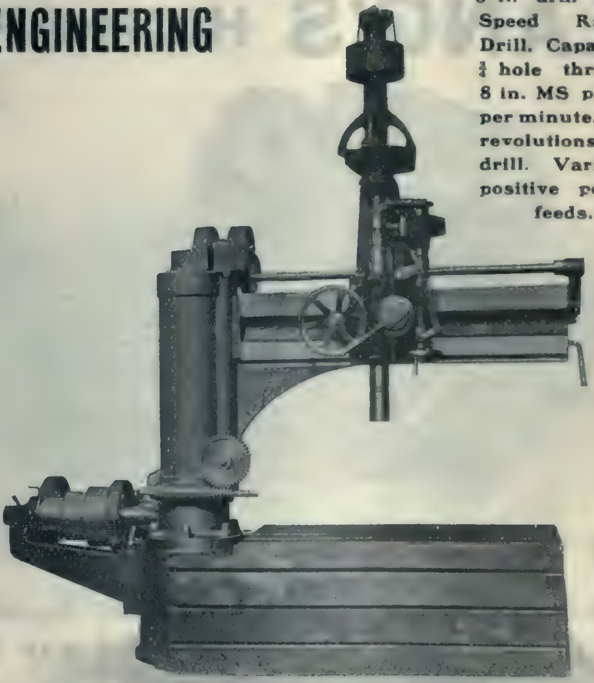
**Estimates given for complete
SHELL MAKING PLANT.**



6 ft. arm High Speed Radial Drill. Capacity, ¾ hole through 8 in. MS plates per minute. 600 revolutions on drill. Variable positive power feeds.

PAGE'S WEEKLY Machine Tools

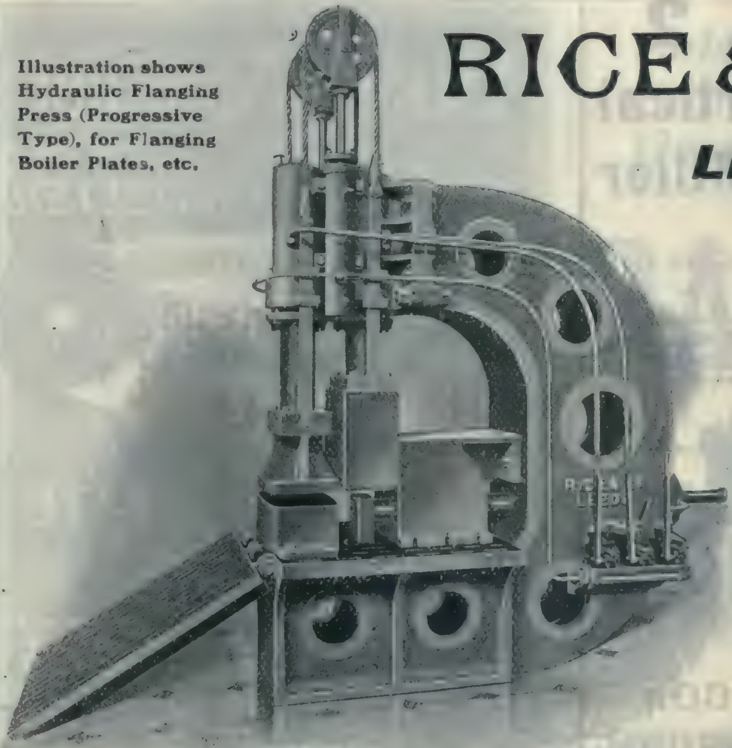


Illustration shows Hydraulic Flanging Press (Progressive Type), for Flanging Boiler Plates, etc.

RICE & CO. (Leeds), LIMITED,

LEEDS,

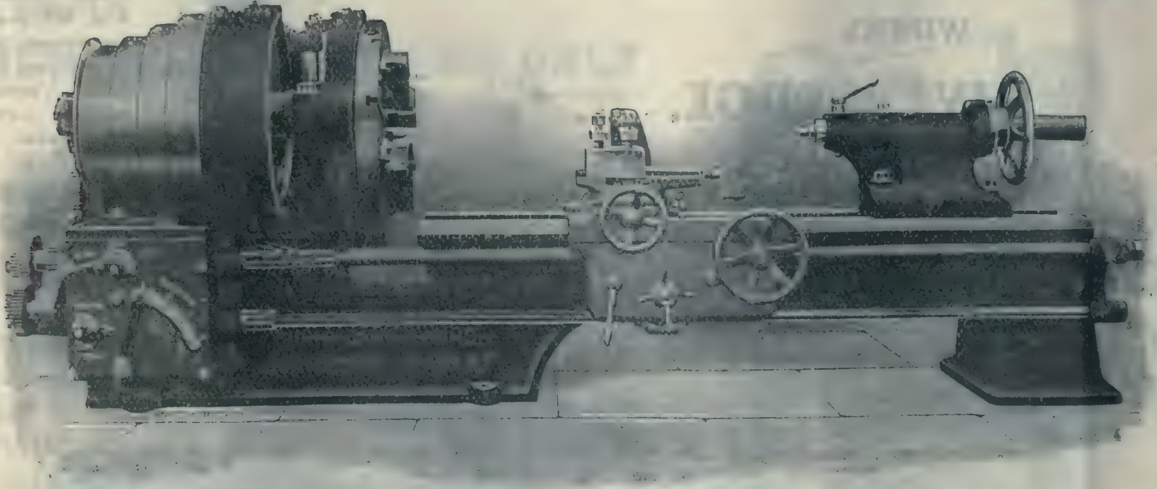
ENGLAND.

HYDRAULIC

Riveters,	Lifts,
Presses,	Pumps,
Cranes,	Accumulators,
Punches,	Intensifiers,
Shears,	Valves,
Hoists,	&c., &c.

A B C Code, 4th Edition, used.
Telegraphic Address: "Press, Leeds."
Telephone No.: 2362.

LANG'S HIGH-SPEED LATHES



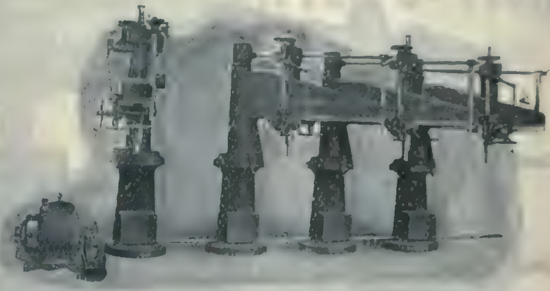
Have Patent Bed, Patent Loose Head, Patent Screw-Cutting and Feed Motions, also Enormous Power combined with Convenience of Manipulation.

JOHN LANG & SONS, Johnstone, near Glasgow.

PROFITABLE DRILLING.

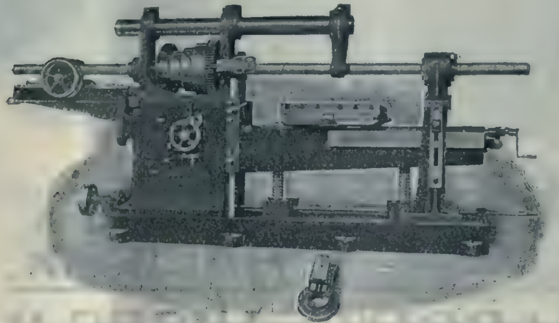
High-Speed Radials

For GIRDER, BRIDGE, and CONSTRUCTIONAL WORK.



Made singly or in gangs. Motor or belt driven. CENTRAL spindle thrust. High spindle velocity. QUICKER than punching, and gives better results.

HUNDREDS SUPPLIED.



Horizontal Drilling and Tapping

Can be executed best

AT MODERN SPEEDS and FEEDS,

on our New Drill, as illustrated.

No side twist on spindle, gear speeds and feeds. Power rotary table. Utmost facility of manipulation. Unequalled efficiency at high speeds.

For . . .

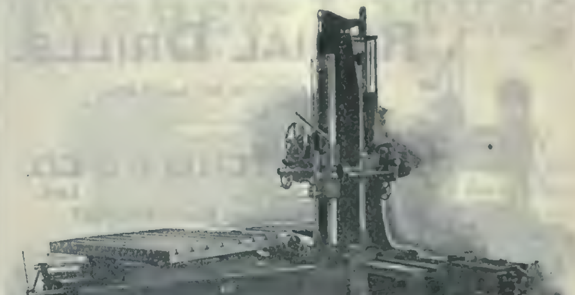
Drilling, Boring, Milling, etc.,

our new Machines, as illustration, are

UNAPPROACHABLE.

Great range of speeds and feeds. Extra power for high speeds. Self-acting in all motions.

THIS MACHINE WILL DO THE WORK OF SEVERAL SPECIAL MACHINES.



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William Asquith, Ltd.,

Well Road Works,

HALIFAX,

ENGLAND.

Contractors to
THE ADMIRALTY,
WAR OFFICE,
and Leading Engineering
Works at Home and Abroad.

PAGE'S WEEKLY Machine Tools

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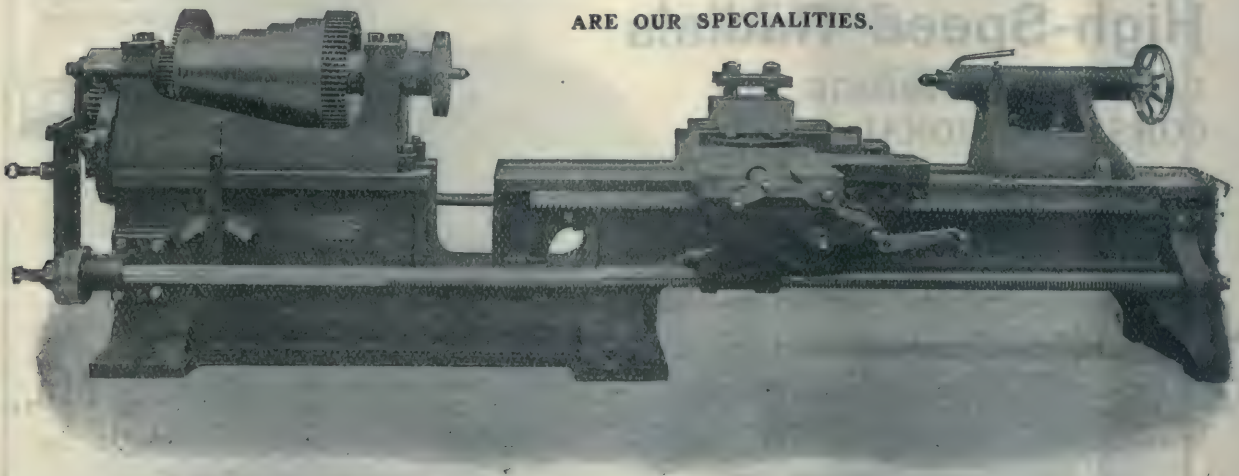
Lathes, Planers, and Shapers

ARE OUR SPECIALITIES.



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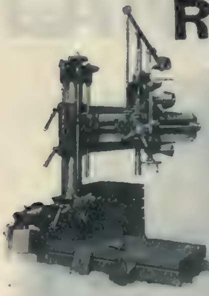
HALIFAX.

HIGH-CLASS LATHES AND RADIAL DRILLS.

Write for our Lists.



D. MITCHELL & CO. Ltd.,
Parsonage Works, KEIGHLEY.

Telegrams: "TOOLS, KEIGHLEY."

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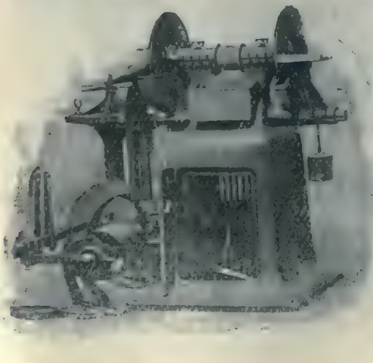
CUNLIFFE & CROOM, LTD.

Broughton Lane,
MANCHESTER



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For Grinding and Finishing all Kinds of Metal.

ASK FOR DESCRIPTIVE LIST.

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A BOOKLET (FOR THE ASKING)

By the
Makers of the

"PERFECT" VISE.

J. PARKINSON & SON,
SHIPLEY, ENGLAND.

Cables: "TEMPLES, SHIPLEY."
Code: A B C 5th Edition.

PAGE'S WEEKLY Machine Tools

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Coventry, England.

Patentees and Manufacturers of

BRETT'S PATENT LIFTERS, ETC.

Pioneers of the Modern System of Drop Forging.

Telegraphic Address :
"LIFTER, COVENTRY."
Telephone No. : 384.

Dean, Smith, & Grace, LTD.,

Lathe Manufacturers,

Established 1865.

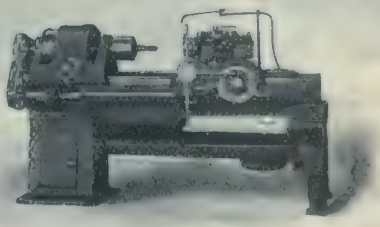
KEIGHLEY.

WRITE FOR CATALOGUE.

See Our Advertisement next Week.

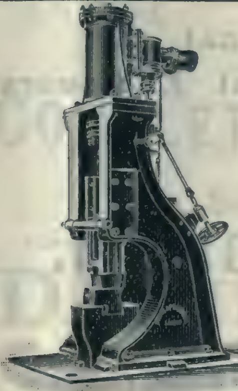
TURRET LATHES.

BRITISH MAKE THROUGHOUT.



See our page Advertisement next week.

THE ECLIPSE TOOL MANUFACTURING CO.,
LINWOOD, near GLASGOW.



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FOR SMITHS' SHOPS AND FORGES.

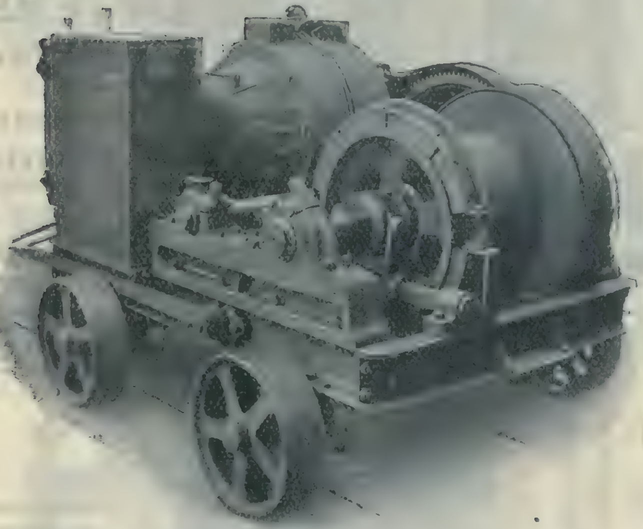
Patent Bevelling Machines for Ships' Frames.

DAVIS & PRIMROSE,

Leith Ironworks, **EDINBURGH.**

ELECTRIC HOISTING and HAULING GEARS.

Send us Particulars of your requirements, or sketch of your workings, when we will submit to you the most Economical Method and our Lowest Prices.



The above shows a 20 B.H.P. Portable Electric Winch arranged to run on road or rails.

SPECIALITIES.

Our Specialities are:—

Secondary Haulage,

Electrically Driven
Three-throw Pumps,

Main and Tail, Main Rope,
Endless Rope, and Portable
Hoisting and Hauling Gears.

M. B. WILD & CO., Mechanical and Electrical Engineers.

Head Offices:—
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CORPORATION STREET, BIRMINGHAM.

Works: NECHELLS, BIRMINGHAM.

Telephone No.: 4608.

Telegrams: "HAULING, BIRMINGHAM."

PAGE'S WEEKLY Friction Clutches

HEYWOOD & BRIDGE'S

Patent Friction Clutches

(30,000 HORSE POWER SUPPLIED IN ONE YEAR.)

A CLUTCH FOR ANY DRIVE.

Any Speed.
Any Power.

Prevents Accidents.

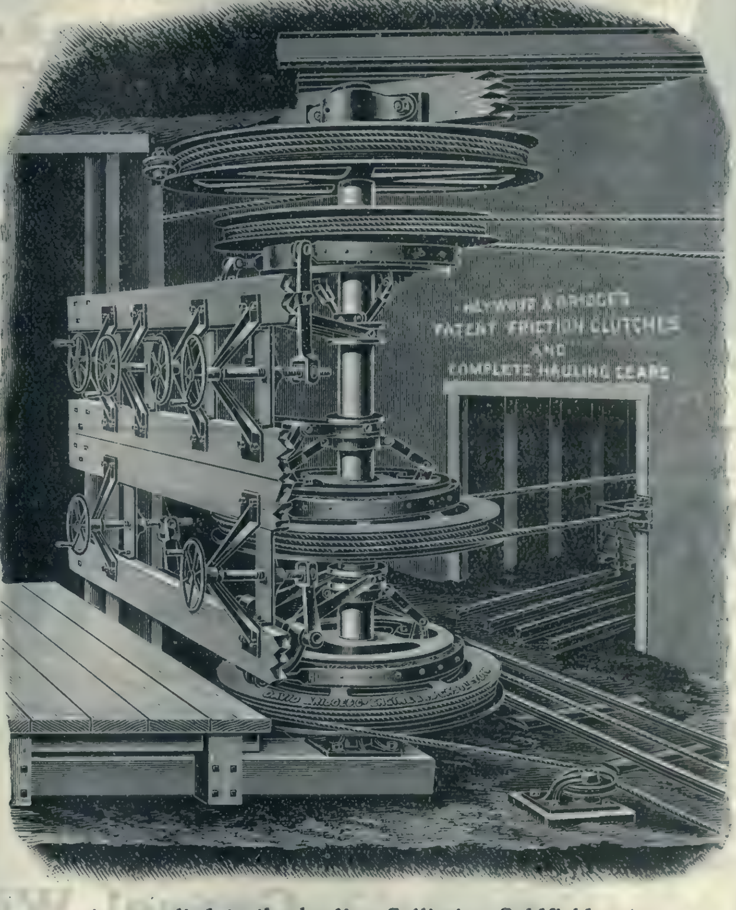
No End-thrust.

Stops and starts gradually, without any shock or jar when running at full speed.

Thousands Working.

Hundreds of repeat orders.

One firm alone has had over 200 Clutches, and they are still placing orders with us.



As supplied to the leading Collieries, Goldfields, etc.

COMPLETE HAULING & GEARING PLANTS.

Send for 200 page Catalogue FREE.

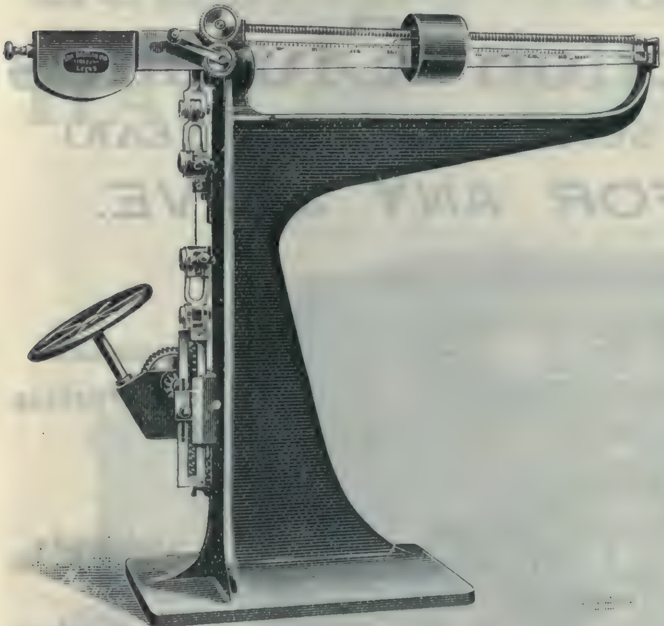
PATENTEES AND SOLE MAKERS—

DAVID BRIDGE & CO.,

Castleton Iron Works, ROCHDALE, Lancs.

PAGE'S WEEKLY Miscellaneous

Denison's SINGLE LEVER Wire Tester.



This apparatus is arranged for ascertaining the tensil strength of small wire, and is very accurate

NO LOOSE WEIGHTS.
ACCURATE EXTENSION GAUGE.

Capacity ... 1,000 lbs. avoir. (1)
,, ... 1,250 ,, ,, (2)
,, ... 1,500 ,, ,, (3)

The 'poise weight carries a vernier to show single pounds.

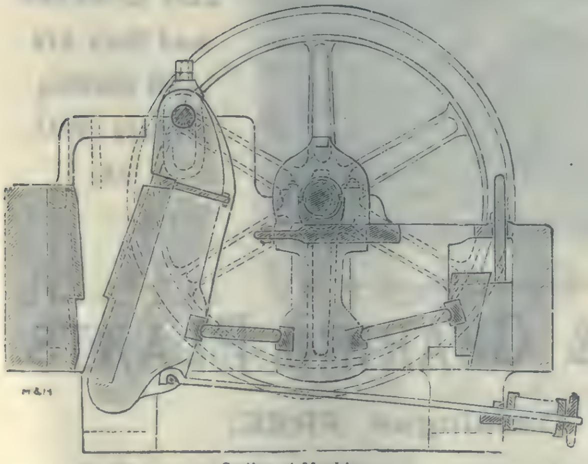
RAPID IN USE.

PATTERN B.

SAML. DENISON & SON, LTD.,
Hunslet Moor,
Near LEEDS.

Telegrams:
"WEIGH, LEEDS."

STONE BREAKERS.
(Improved Blake Type.)

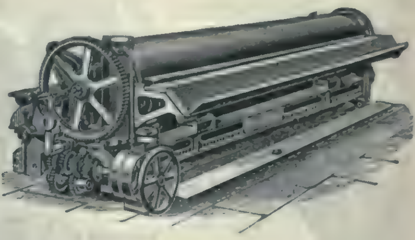


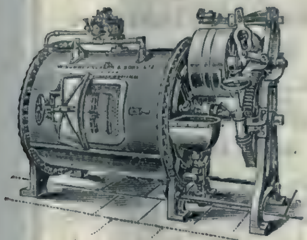
Section of Machine.

Rollers,
Screens,
Gravel Washers,
Concrete Mixers.

SAMUEL PEGG & SON,
Alexander Street, LEICESTER, ENGLAND.

National Telephone 104.





Laundry Machinery

AND COOKING APPARATUS.

W. Summerscales & Sons, Ltd.

CATALOGUE ON APPLICATION. *Phœnix Foundry*, KEIGHLEY, ENGLAND.

PLEASE MARK INQUIRIES P.W.

FIREWOOD AND LIGHTER MACHINERY

DOES THE WORK of from 12 to 80 MEN.

A CERTAIN LARGE INCOME.

THE SAVING IN WAGES ALONE REPRESENTS

ONLY "IDEAL" SAW GUARDS CAN FIT ANY SIZE

IF GUARDS BIND OR DO NOT FIT EXPECT ACCIDENTS AND LESS WORK.

M. GLOVER & Co LEEDS. PATENTEES FIRE WOOD & LIGHTER. MACHINERY, &c.

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Coffee Separators, Coffee Polishers, Coffee Pulpers, Coffee Washers, Graders, Classifiers, Roasters, Cooling Vats, Aspirators, and Dust Collectors.

GRAIN & SEED CLEANING MACHINERY.

RICE CLEANING & GRADING MACHINERY.

Contractors to His Majesty's Government, War Office, &c.

The S. HOWES Co., 64, Mark Lane, LONDON, E.C.

Oldest and Largest Manufacturers of this class of Machinery.

PAGE'S WEEKLY Piston Rings, Packings, &c.

"THE LANCASTER"
R.T.M.
SECTION OF RING & SPRING
SHOWING HOW THE SPRING BEDS TO WHOLE OF THE INNER SURFACE OF RING.
PISTON RINGS & SPIRAL SPRING

The Rings are made from our special mixture of the finest cold blast iron alloyed with aluminium.

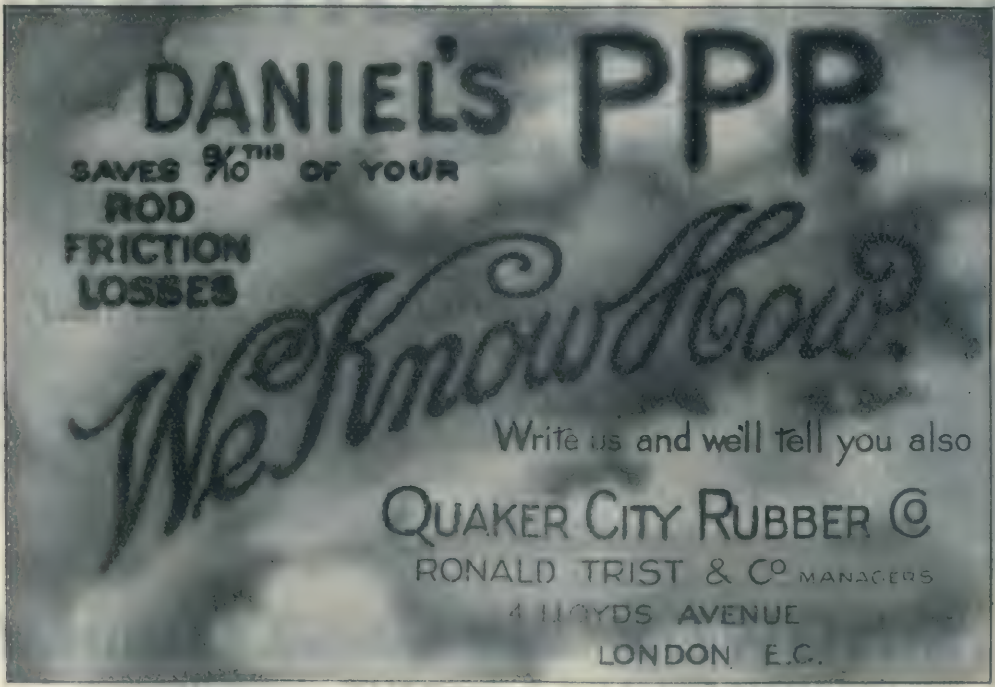
They are exceptionally close-grained, hard yet tough, and take a high polish.

The Springs are coiled from the best steel, and are so gauged as to supply a steam-tight piston with a minimum of friction.

Used by the largest engineers, three firms alone having had over **6,000** sets.

Write for Catalogue C. FIRST ORDERS SENT ON APPROVAL.

LANCASTER & TONGE, LTD.,
Pendleton, MANCHESTER.



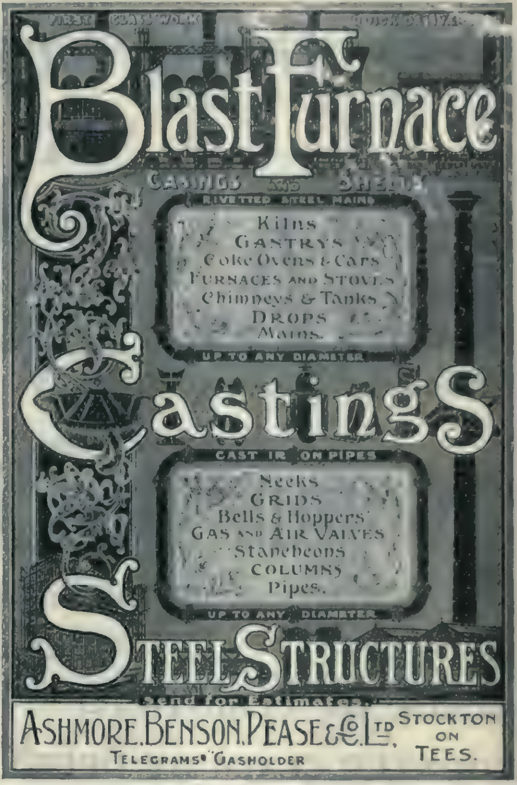
DANIEL'S PPP.
SAVES $^{9}/_{10}$THS OF YOUR
ROD
FRICTION
LOSSES
We Know How?
Write us and we'll tell you also
QUAKER CITY RUBBER Co
RONALD TRIST & Co MANAGERS
4 LLOYDS AVENUE
LONDON E.C.

PAGE'S WEEKLY Steelwork, &c.

CLAYTON, SON & Co., LTD.
HUNSLET, LEEDS,
MAKERS OF THE
LARGEST STEEL TANK
AND THE
LARGEST GASHOLDER
IN THE WORLD.

ROOFING,
CONSTRUCTURAL
STEEL WORK,
PETROLEUM TANKS.

Wires:— "Gas, Leeds."
London Office:— 60, Queen Victoria Street.



Blast Furnace
CASTINGS AND SHELLS
RIVETTED STEEL MAINS
Kilns
GANTRYS
Coke Ovens & Cars
FURNACES AND STOVES
Chimneys & Tanks
DROPS
Mains.
UP TO ANY DIAMETER
Castings
CAST IRON PIPES
Necks
GRIDS
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GAS AND AIR VALVES
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COLUMNS
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UP TO ANY DIAMETER
STEEL STRUCTURES
Send for Estimates.
ASHMORE, BENSON, PEASE & Co. LTD. STOCKTON ON TEES.
TELEGRAMS "GASHOLDER"

The Phosphor Bronze Co., LTD.,
SOUTHWARK, LONDON, S.E.

Sole Makers of the Original
"Cogwheel" and "Vulcan" Brands of Dr. Künzel's
"PHOSPHOR BRONZE" ALLOYS
which have for many years been recognised as
THE BEST & MOST DURABLE METALS
for
Slide Valves, Bearings, Bushes, Eccentric Straps, and other parts of Machinery Exposed to Friction and Wear.
Also for Pump Rods, Pumps, Piston Rings, Pinions, Worm Wheels
MOTOR GEARING, Etc.

Castings in Phosphor Bronze, Gun Metal, Manganese Bronze, and Aluminium Alloys. Machined if required.

PHOSPHOR BRONZE,
MANGANESE BRONZE,
"WHITE ANT" METAL,
PLASTIC METAL,
BABBITTS METAL,
ALUMINIUM
ALLOYS.

PAGE'S WEEKLY Conveying Plants

The Great Engineering Law Suit.

GRAHAM, MORTON

MAURICE GRAHAM, **& Co., Ltd.,**

v.

Compagnie L'Union des Gaz.

17 Days in Court, King's Bench Division.

CLAIM BY PLAINTIFFS	£5,483 5 4
COUNTER-CLAIM BY DEFENDANTS	£70,000 0 0

Extract from Mr. JUSTICE GRANTHAM'S JUDGMENT, May 15th, 1905.

"The history of the case is very remarkable, and as far as my experience is concerned quite exceptional, and does not reflect very great credit on the Defendants in making such serious charges against a firm who did so much—as it was admitted by Defendants' witnesses the Plaintiffs did—to assist the Defendants in fulfilling their own contracts with the authorities at Milan.

"NEVER was an instance in which work of such magnitude was done under such difficulties as this work was begun, continued, and completed by the Plaintiffs."

"NEVER were Contractors, according to the evidence of the Defendants' Engineers, so anxious to fulfil their obligations and spend their money lavishly to enable them to carry out loyally their contract with the Defendants."

"NEVER did work receive such commendation by the persons for whom it was done during its progress and after it was completed as in this case."

"NO WORDS of greater praise were ever written on work performed by any Contractors."

"Judgment is for the Plaintiffs on the Claim and Counter-Claim, with Costs on the Higher Scale."

RESULT OF A TEST

OF ONE OF

BULLIVANTS' STEEL WIRE ROPES

AFTER WORKING $3\frac{3}{4}$ YEARS.

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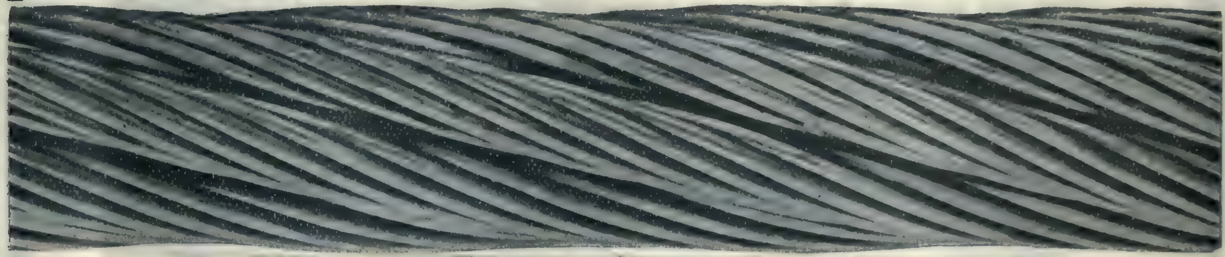

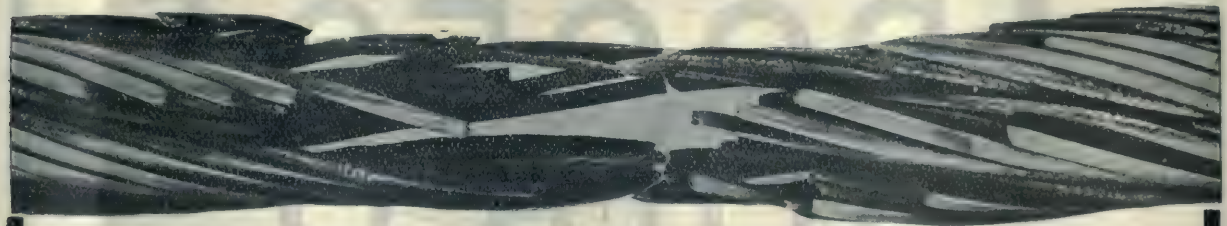

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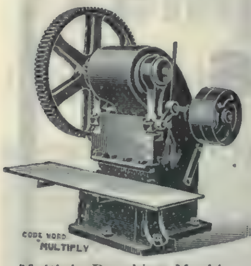

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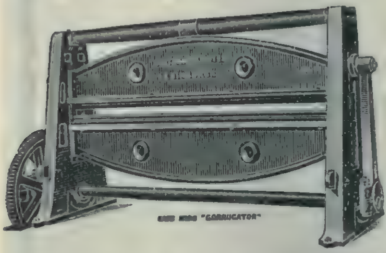

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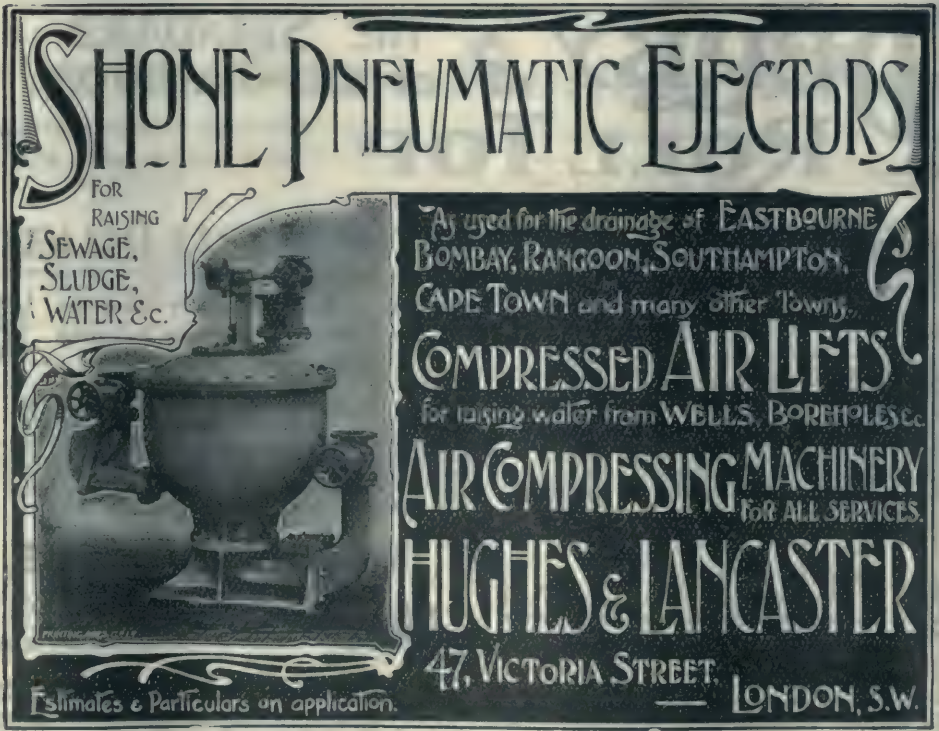

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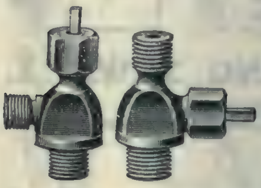

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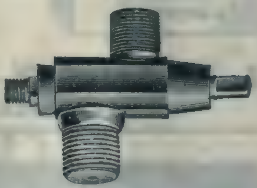

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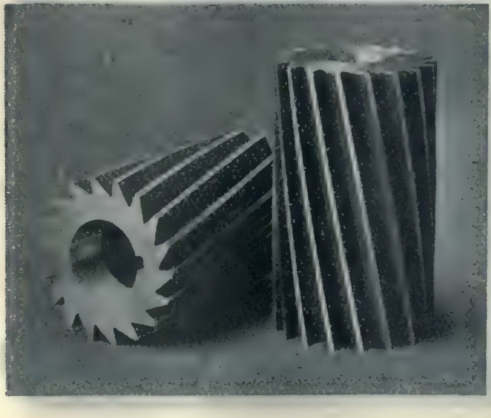

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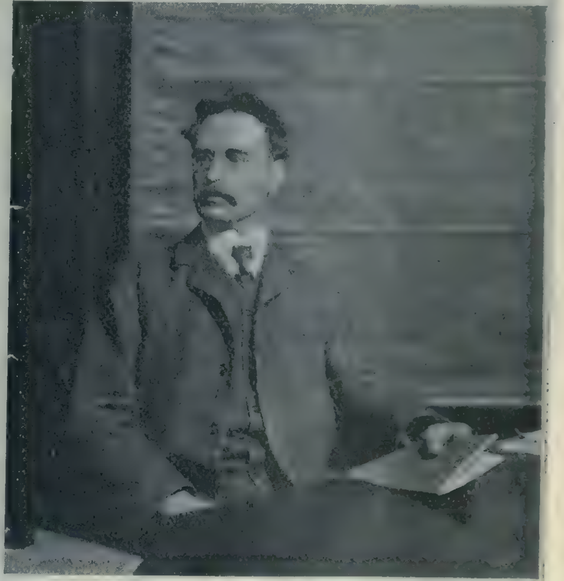
VOL. VII. LONDON, FRIDAY, AUGUST 4, 1905. NO. 47.

The Offices of "Page's Weekly," Wednesday Evening.

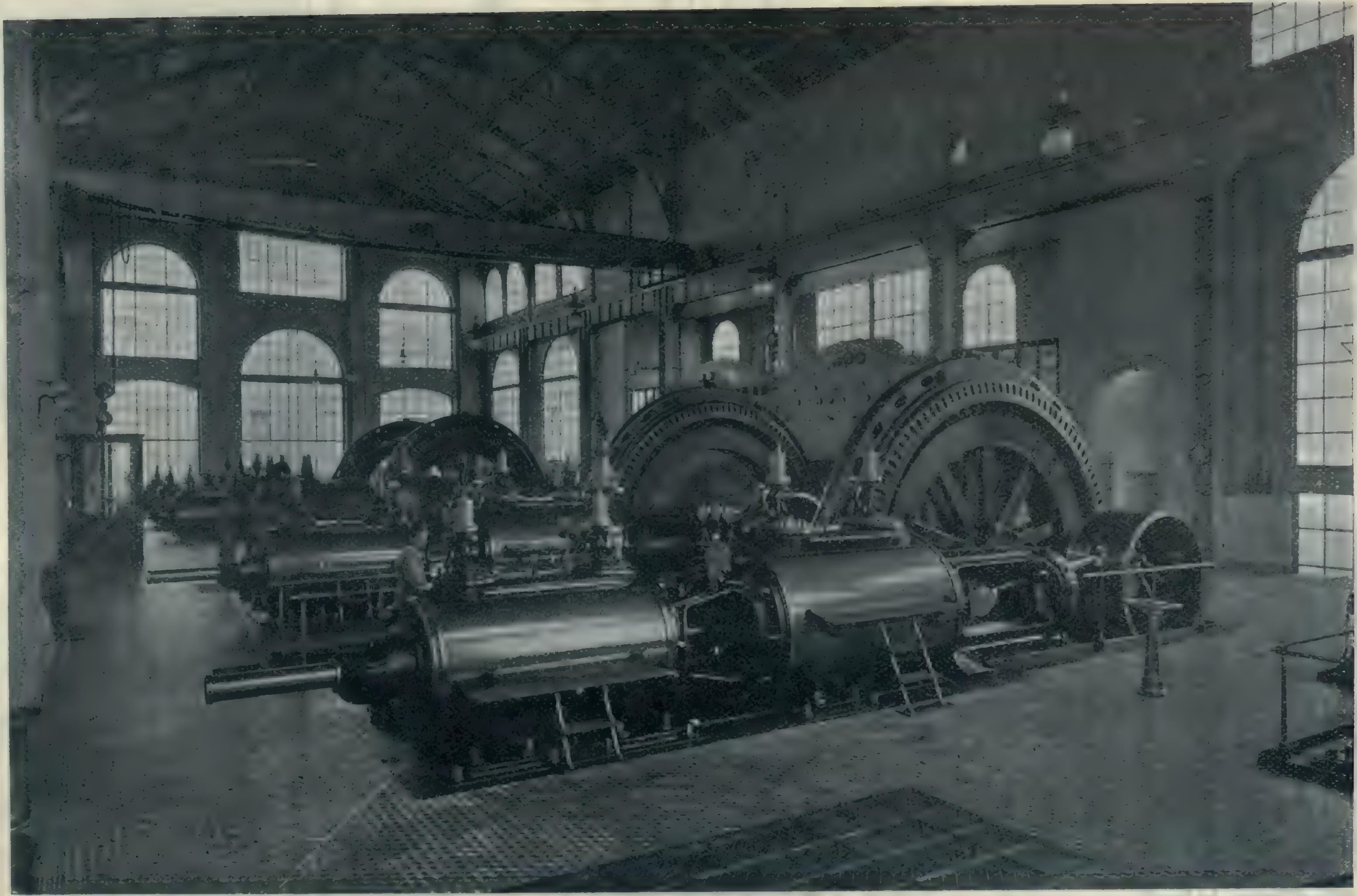
REFERENCE has already been made in PAGE'S WEEKLY to the important series of lectures delivered by Mr. Dugald Clerk before the Society of Arts on a subject he has made his own—the "Internal Combustion Engine." Mr. Dugald Clerk, as might be expected, raises many points of interest, and the lectures may be commended to the notice of all those interested in gas-engine developments. Dealing with the constant pressure engine he points out the difficulty of getting as high compression as possible without exceeding the temperature of ignition of the particular mixture of inflammable gas and vapour used. As gases which contain a large proportion of hydrogen ignite at comparatively low temperatures, it is clearly necessary if pre-ignition is to be avoided to keep down the compression. Pre-ignition is the main limiting circumstance which prevents the highest pressure being used in motors of the constant volume type, and the trouble becomes more pronounced with large engines. Fortunately, most very large gas engines use blast-furnace gas which, containing but little hydrogen, can consequently stand a high compression without pre-ignition.

Mr. Dugald Clerk is of opinion, however, that up to 300 h.p. all difficulties with regard to gas engines have been overcome. In large engines there is undoubtedly still considerable room for difference of opinion among engineers and they are now fighting out the battle of the big engine. A great many of the existing troubles with large engines arise from the intense temperature of explosion and expansion. In his last lecture Mr. Clerk discussed some modern developments of the gas-engine industry, including suction producers, blast furnace gas and producer gas distributed from central stations. He is of opinion that the suction



C. E. L. BROWN.

Prominent as a designer of electrical machinery on the Continent. In his article on "British Engineering on the Continent" (*page* 233), Mr. Kilburn Scott remarks that Mr. Brown, although still a young man, has practically established what may be termed a Brown School of Design.



Photo, Booker and Sullivan.

CONTINENTAL POWER STATIONS—ALFORTVILLE INSTALLATION OF THE COMPAGNIE DE L'EST LUMIERE PARISIEN.

The installation at this station, which supplies current for power and light, consists of two Carels Frères tandem engines of 1,000 h.p., each with the following principal dimensions: h.p. cylinder, 24 in.; l.p. cylinder, 38 in.; piston stroke, 41½ in; speed, 100 revolutions. This engine is connected with an alternator working three phase at 50 periods per second—with a capacity of 5,000 amperes. More recently the company have installed four additional engines.

producer is destined to make very rapid strides, notwithstanding the fact that in blast-furnace gas a very important source of power is practically going to waste. Mr. Clerk looks upon this latter as one of the great developments of the future, for much remains to be done before the 1,000,000 h.p., at which he puts the waste from the iron furnaces of this country, is utilised. Interesting developments, he thinks, are likely to follow the keen competition which has now set in between coal gas and suction producer gas. With regard to the utilisation of cheap bituminous fuel for producers, in which only the early commercial stage has yet been reached, there is not, of course, much difficulty in using bituminous fuel in conjunction with a scrubbing plant, but people using steam boilers are accustomed to see a very large generation of power in a very small boiler space, and they do not look upon the large costly plants which are used in some places as solving this particular problem.

Mr. B. H. Thwaite is referred to in connection with the utilisation of blast-furnace gas as one of the first to deal with this question. A handicap felt by British gas engineers in attempting to work blast-furnace gas, which has been referred to in PAGE'S WEEKLY on several occasions, is the difficulty of scrubbing, because obviously a very small amount of grit or tar coming in contact with the gas spoils an engine. A great deal, however, depends upon the gas used, the grit in gas depending very largely upon the composition of the iron ore smelted, so that in one district a gas may be obtained practically free from dust, while in another district the gas is laden with a fine silicious dust. However. partly by scrubbing with ordinary scrubbers, partly by using a centrifugal separator, the difficulty has, Mr. Clerk points out, been practically overcome, so that on the Continent there are quite a number of installations successfully using blast-furnace gas, and even English engineers are now taking up the manufacture of these engines.

The application of internal combustion motors to marine work naturally received attention in these lectures. The first step in this direction was the fitting of petrol engines into motor-boats, but these were motor-car engines pure and simple. A more important development in this direction is the application of producer gas to sea-going purposes. The sources of petrol are obviously so limited that little can be done in the way of motive power at sea with petrol, and the marine problem in connection with the internal combustion engine will only be successfully solved by the use of coal. Mr. Dugald Clerk looks forward to rapid progress in this direction, and predicts that in a few years liners will be run without steam at all, with nothing but gas plant and gas engines on board, and using electricity for their auxiliary power.

As to the line of advance in the future, the thermal efficiency of the gas-engine can undoutedly be much improved. A consideration of the different cycles will show that if the constant pressure cycle could be adopted, and the difficulties of constant pressure engines overcome, we should get instead of a theoretical efficiency of about 48, a theoretical efficiency of about 64, and a practical indicated efficiency of considerably over 40 per cent. There are other ways of increasing the efficiency, notably the reduction of the temperature of the flame. That this could be done is clear, because the economy of any "Otto" four-cycle engine is independent of the maximum temperature of the flame if the temperature of the flame is above the temperature of compression. With regard to large engines in particular it is desirable to reduce flame temperature to the lowest possible point, as in this way the cylinder and pistons are enabled to better withstand the strains of unequal expansion. Mr. Dugald Clerk has been working on these lines with fair success, a 300-h.p. engine, designed on the air super-compression principle, having worked very well indeed. However, the most important points for immediate attention in connection with the development of the gas engine are rather on the mechanical than the thermodynamic side; that is, to improve the number of impulses, to improve the mean torque so that it may be more regular, and to produce improved methods of governing. In marine work, too, it will be necessary to reverse the engine itself, and the problem of reversing the engine and dispensing with the reversing clutch-gear still awaits solution. With regard to the gas turbine, Mr. Clerk is very emphatic that until someone invents or discovers an efficient gas and air compressor of the turbine type, there is no possible hope for efficiency with the gas turbine

---

In the course of a paper on the submarine as an enemy, contributed to the U.S. Naval Institute, Lieutenant A. B. Hoff summarises the qualities of this class of vessel as follows:—1. Slow speed. 2. Great weight for internal capacity. 3. Inability to see or judge distances well, except in smooth water. 4. Sluggish in all movements—diving, turning, or answering engines. 5. Inability to allow for current, when running submerged. 6. Visibility of tower or periscope by day. 7. Vulnerability to gun-fire. The one and only quality it has in its favour is invisibility. Its whole reason or being depends on this alone. In concluding a somewhat speculative essay the writer brings out strongly the fact that the great handicaps of a submarine have not altogether been considered in the more or less fanciful *roles* popularly assigned to it. The Moniteur de la Flotte gives some details of the salvage of the *Farfadet*, from which it appears that the damage to the submarine is not great. The hull is almost intact, and is of such strength that it is hardly marked by the heavy chains used for raising it. The accumulators, the rudder, the motors, and other parts of the machinery, have suffered considerably, and part of the woodwork is completely smashed.

The members and governors of the Royal Agricultural Society have met and discussed the fate of Park Royal, but a long meeting came to an end without any decision being reached. Sir John Thorold, who presided, counselled patience as a way out of the *impasse*; but other speakers were in favour of lopping off Park Royal and making a fresh start. In the minds of some there appears to be a lurking suspicion that the failure of the Park Royal show is not due to its situation, or the fact of its being used as a permanent show ground, but is rather the outcome of other circumstances which have made it difficult for the parent body to hold shows which will be financially successful. The Royal Society once held the field, but in recent years its usefulness has been limited by the creation of county agricultural societies, and it would almost appear that a complete change of policy is necessary if the Society is to remain a vital force. This view of the position is commended to the notice of the Special Committee which has been appointed to deal with the whole question.

Those anxious to promote the iron industry in Australia, says the Glasgow Herald, are growing impatient at the entire lack of progress with the Bill for providing a bonus on steel production in the Commonwealth. There has been no want of enterprise on the part of ironmasters. The Blythe River Company alone were prepared to expend a million sterling on works for the production of 100,000 tons of iron per annum. The Royal Commission on the subject has proved that four and a half millions were being spent each year on iron and steel manufactures imported.

PAGE'S WEEKLY

An Illustrated Technical Weekly, dealing with the Engineering, Electrical, Mining, Iron and Steel, and Shipbuilding Industries.

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Alterations, &c., intended for insertion in the current week's issue must be delivered **not later than 4 p.m. on Monday.** If proofs are required the copy and blocks should reach us several days earlier.

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NEWS ITEMS.

DURING the past month, shipbuilders in Scotland have launched sixteen vessels of 22,124 tons. The output for the seven months of this year amounts to 281,984 tons, being 46,472 tons more than for the same period of 1904.

The new armour-plate manufacturing plant which Cammell, Laird and Co., Ltd., are laying down at their Sheffield works, is rapidly approaching completion. The extension will include one of the largest armour-plate mills in the world.

In order to deal with exceptionally heavy loads, a 100-ton crane has been erected at the North Wall of Dublin Harbour, and has been tested to a strain of 150 tons. The gear includes three electric motors—one for hoisting a load of 20 tons, another for loads of 100 tons, and the third for traversing loads in and out.

The Commercial Intelligence Branch of the Board of Trade have received from the British Commercial Agent in the United States a copy of a notice issued from the office of the General Purchasing Officer at Washington for the Isthmian Canal Commission, calling for tenders for the supply of printing presses, hardware, cotton duck, wire rope, etc. A copy of the specification may be examined at the offices of the Commercial Intelligence branch of the Board of Trade 73, Basinghall Street, E.C.

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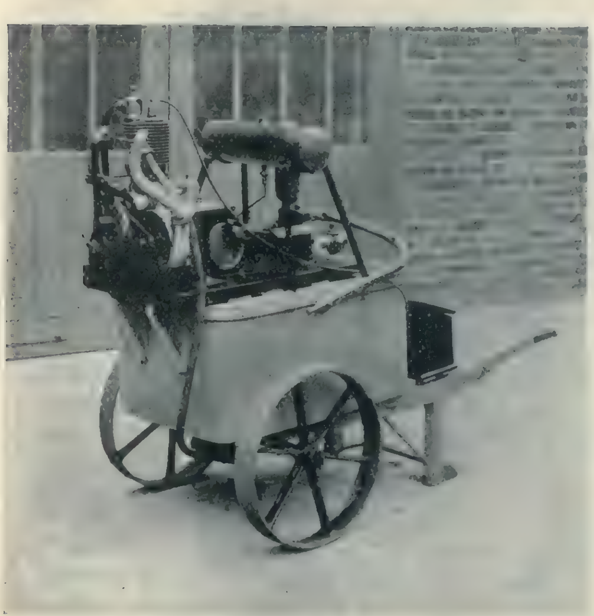


A NEW SPRAYING AND WATERING ENGINE.

Petrol Motor Pumps, etc.

We illustrate above Merryweather's new patent "Novelty" Petrol Motor, Spraying and Watering Engine. This machine consists of a tank holding 35 gallons, bolted on a two-wheeled barrow, and having mounted on it a powerful little petrol motor driving a double-barrel pump. The pump is driven through an ingenious worm gear, with ball bearings, to reduce loss of power by friction. It can draw water from a pond, stream, or other supply, and fill its own tank. Insecticide can then be mixed with the water, and the pump will deliver at high pressure to three or four hop-washing or fruit spraying nozzles simultaneously. It will also deliver over 30 gallons per minute for watering or throw a powerful jet for fire extinction.

On the opposite page is shown the same firm's new patent "Waterspout" Petrol Motor Centrifugal Pump for irrigation, draining, mining work, etc. It has a light iron carriage on four wheels, with double-cylinder petrol engine driving centrifugal pump direct. The capacity of the pump is 18,000 gallons per hour, with a lift of 12 ft., and it can be used where steam pumps cannot be transported. By disconnecting the pump the motor can be used to drive other machinery by means of belting. A float-feed carburetter is fitted and high-tension electric ignition. The motor is water-cooled, part of the delivery from the centrifugal pump passing through the water-jackets, so that the machine can, it is claimed, be run for hours without any danger of over heating.

Thames Navigation.

The Bill for the improvement of the Thames channel between the Nore and Gravesend has now gone before a Select Committee of the House of Lords. The Bill provides for the putting in force of powers to form a channel between the Nore and Gravesend not less than 30 ft. deep at the low-water of ordinary spring tides and not less than 1,000 ft. wide throughout. Between those two points there is only a length of nine miles altogether in which there is not already a depth of 30 ft. at low water. The distance is made up of one mile below Gravesend, two miles in the lower Hope reach, and six miles at the Leigh Middle Shoal. It is intended to dredge these portions so as to secure a channel of uniform depth. The total cost of the works, including dredging plant, interest, and sinking fund charges, is estimated at £377,680.

Liege Exhibition.

Prince Albert of Belgium has again visited the Exhibition for the purpose of inspecting the machinery Sections, and visited those of Belgium and parts of France America, Germany, and England, spending from 10 a.m. to 1 p.m. in the halls, where he was highly interested. Amongst the last exhibits the Prince honoured with his presence was that of Messrs. Sir W. G. Armstrong, Whitworth and Co., Ltd., where he was received by the British Commissioner. His Royal Highness was shown a lathe, cutting steel at 18 metres a minute, with a cut 22 m.m. deep and 6½ m.m. advance, and a drilling machine drilling cast-iron at the rate of 20 in. per minute. He was subsequently shown a slab milling machine cutting steel ½ in. deep at one cut, and the cutter running at 38 metres a minute, and also a lathe cutting steel at 50 metres a minute. We understand these results are being obtained by Messrs. Armstrong and Whitworth's high-speed machine and A.W. tool steel.

Wolfram in Queensland.

The largely increased consumption of wolfram in the manufacture of high-grade steel has, it is pointed out in an official report, created a demand that has met with a ready response in Queensland. Indeed, the Northern portion of the State appears to be one of the principal sources of the world's supply of the mineral; and, while the total output from 1894, when any mention of wolfram first appears in reports, up to the end of 1903, was 996 tons, valued at £30,894; last year's production, from the figures furnished by the Wardens, reached 1,539 tons, of a value of £161,635, the value of the wolfram ore actually exported during the same period being returned by the Customs at £96,000.

The Iron and Steel Industry in Mexico.

In connection with the iron and steel trade of Mexico it is interesting to note, says a Foreign Office report, that in view of the considerable development of electricity, and the recent discoveries of mineral oils (notably at Ebano, Papantla and on the Isthmus of Tehuantepec), and the fact that iron ores of good quality are known to exist in various parts of Mexico in very considerable bodies, it is probable electrical energy may be successfully used in the near future in electro-metallurgical methods of smelting iron ores. Indeed electricity has been successfully used in Mexico in the reduction of ores, notably at Monterrey and in Chihuahua. With the introduction of modern metallurgical methods, it is considered that Mexico will probably export fewer ores than heretofore, and there will be more and more treated in the country.

The Cape Government Railways.

Mr. W. Stevenson, traffic manager of the Northern System, reports that the total number of miles run on the system was 351,209 as compared with 530,712 for the corresponding period of 1903, or a saving of 179,503 miles. This saving is due in a great measure to a larger number of heavy locomotives being employed on this system than formerly, thus enabling fewer trains to haul the goods traffic. In order to show to what an extent the power of the engines has increased he mentions that the average load of goods trains between De Aar and Kimberley was 434 tons during the year, whereas up to a few months ago previously the heaviest engine only hauled 380 tons.

Mr. W. S. Doran.

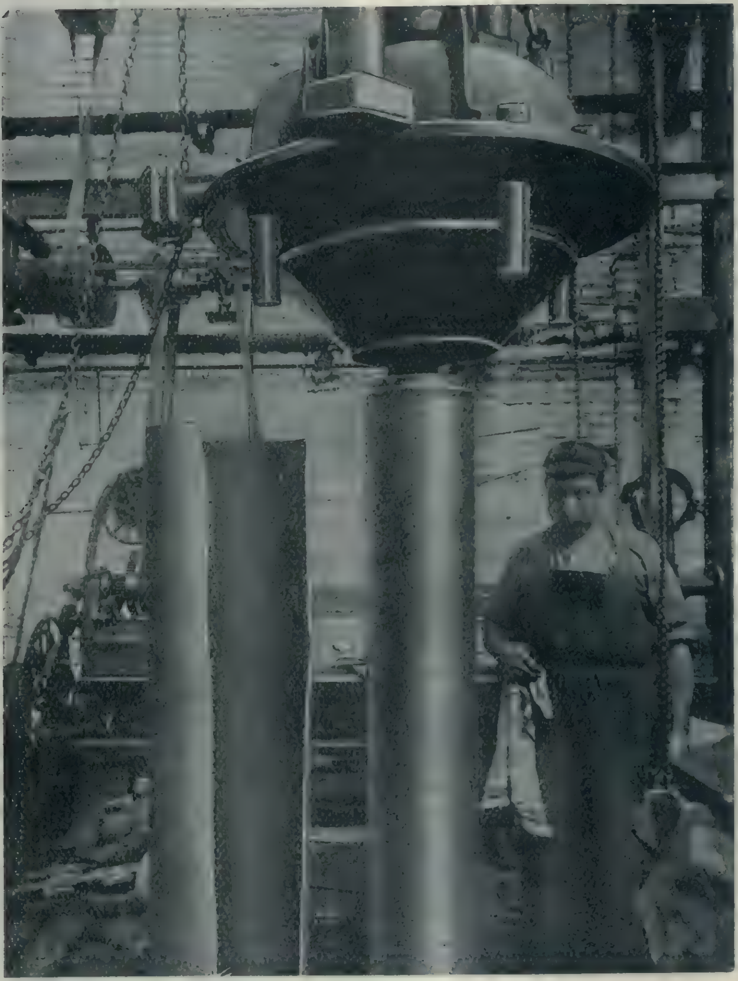
A hundred friends of Mr. W. S. Doran assembled no Thursday night at the Hotel Cecil to give him a farewell dinner previous to his departure for the United States, where he intends to take up his residence. Mr. Doran was formerly with the Worthington Pump Company, but has been associated for the last few years with the Westinghouse interests in this country. His genial manner has gained him many friends, and he will be greatly missed by all those who have come into contact with him.

Coal Consumption in Destroyers.

Some figures relating to the coal consumption of destroyers with the China Squadron, reported by a correspondent of the Western Morning News, are of considerable interest to naval engineers at this juncture, when the cruising power of warships is a vital problem. The destroyers with the China Squadron were the *Virago, Fame, Whiting, Handy*, and *Otter*, and the run was from Shanghai to Wei-hai-Wei. On this occasion the chief artificer-engineer was Mr. H. Leverett, of the *Handy*, whose services in connection with the boiler trials of H.M.S. *Medusa*, in 1904, have already met with favourable recognition from the Admiralty, and who so recently secured a successful trial from H.M.S. *Humber* on reduced coal consumption. He secured the premier honours of the trip by having maintained a cruising speed varying from 12 to 8 knots on the low coal consumption of only twenty tons.

The official circular of the Tramways and Light Railways Association for July contains some useful information concerning light railway orders, and a copy of Mr. Bigwood's Vehicles Lights Bill, regulating the carrying of rear lights by all road vehicles, which Bill was only lost by one vote, and will probably be reintroduced on the first favourable opportunity.

OIL ENGINE AND HATFIELD PUMP.



THE RAPID ELECTRO-DEPOSITION OF COPPER.

An illustration showing the apparatus employed for the Centrifugal process, as recently described in these columns by Mr. Sherard Cowper-Coles. The mandrel is provided with Pelton wheels, which are driven by the electrolyte impinging against them.

Motor Omnibus Engineers.

A new institution has been formed with the title: "The Society of Motor Omnibus Engineers." Its objects are sufficiently indicated in the title. Membership is limited to engineers or engineering managers in charge of motor omnibus undertakings, or their approved assistant engineers or assistant engineer managers, and provision is made for both associated membership and full membership.

A New French Cruiser.

The French armoured cruiser *Leon Gambetta* has just finished a most satisfactory series of trial trips off Brest. The twenty-four hour trial trip at full speed with natural draught, and with the twenty-eight boilers working, realised 16,190 h.p., and a speed of 20·05 knots. The three hours' trial trip realised 52·720 h.p., and a speed of 22·4 knots.

BRITISH ENGINEERING ON THE CONTINENT.

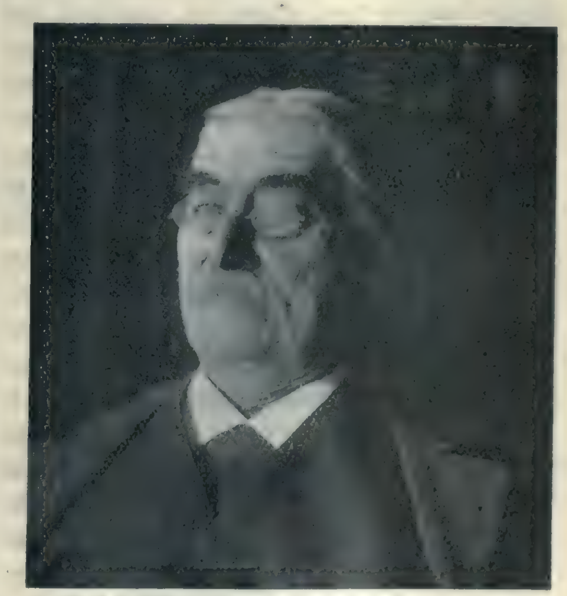
By E. Kilburn Scott, A.M.Inst.C.E., M.I.E.E.

BRITISH engineers who travel much on the Continent have reason to be proud of those pioneers of their profession who first went over and introduced railways, cotton and cloth factories, engineering works, etc. In Russia, for example, the Englishman will find that the founders of all the textile centres, and many of the iron works, were men from the North of England, whose names are now forgotten, but who have each helped, in their small way, to build up the reputation which we have inherited.

In Brussels one of the most imposing statues is that of a South Staffordshire man—Cockerill, the founder of the engineering works at Seraing, which rank amongst the largest in the world.

The handiwork of the British engineer is to be seen all over Spain, and the magnificent arsenals in the Mediterranean are monuments to the enterprise of some of our best-known north country firms.

In Germany, the name of William Lindley, who died at the age of 92 only a few years ago, is a name to be proud of, for he was one of the pioneers of civil engineering and sanitary science on the Continent. To him are due the water and drainage systems of Hamburg, Frankfort-on-Main, Warsaw, and many other towns. His son, Mr. W. H. Lindley, M.Inst.C.E., designed the municipal electric light and power stations of Frankfort-on-Main and of Elberfeld, which are amongst the most successful. The machinery in both these stations is also the work of an engineer of English descent, Mr. C. E. L. Brown, the well-known electrical engineer, who, although still a young man, has left such an impress on electrical machine design as to have practically established what may be termed a Brown School of Design. It can be traced right through the Continent and to England, beauty of form and line being one of its characteristics. Mr. Charles Brown, the elder, still lives at Basle at the age of 78, and he is one of the most interesting personalities the writer has ever had the pleasure of meeting. When 17 years of age it was his fortune to be engaged by the great Michael Faraday to make experimental apparatus, some of which is now religiously preserved



CHARLES BROWN,
Who assisted Michael Faraday and afterwards played an important part in continental engineering.

W. H. LINDLEY, M.INST.C.E.

To Mr. Lindley and his father the Continent owes some of its most successful schemes of municipal engineering.

at the Royal Institution. Faraday took an interest in his clever assistant, and obtained for him a berth with Mawdsley. There he met young Mr. Sulzer, and went out with him to Switzerland in 1851, where he organised the works of Sulzer Frères, and it is a splendid testimonial to Mr. Brown's engineering skill and foresight that the Sulzer engine, acknowledged to be the finest of its class in the world, is being made to-day in all essential details exactly as Charles Brown designed it over thirty years ago. Besides stationary engines, Mr. Brown also left his mark on the Winterthur locomotives, of which works he was also manager. Amongst other work, Mr. Brown designed and laid out the Arsenal and shipbuilding works which Messrs. Armstrong, Whitworth and Co. equipped near Naples. British engineers have been fortunate in having such a representative. On the other hand, Swiss engineers thank him for material assistance in enabling a country with no coal, minerals, seaports or Colonies, to obtain the reputation they have to-day in the engineering world.

UNIVERSITY INTELLIGENCE.

FACULTY OF ENGINEERING.—B.Sc. Engineering (Metallurgy) Examination for Internal Students. 1905. Pass list.—Nanabhai Dayabhai Darn, Royal College of Science.

FACULTY OF ENGINEERING.—B.Sc. Engineering Examination for Internal Students. 1905.

Pass.—Roy Remington Elliott, Central Technical College; John Nealor, Central Technical College; John Hulse Machin Nichols, University College; Martin Lewis Thomas, King's College; Wesley Turner, Central Technical College.

Honours.—First Class: Alfred Martin Beale, Central Technical College; Robert Oliphant Boswall, King's College; Herbert Edward Hodgson, South-Western Polytechnic; Francis John Kean, University College; Albert Edward O'Dell, King's College; Ernest Hinkley Salmon, East London College.

Second Class.—Alfred Philip Chalkley, King's College; Stephen Lacey, Central Technical College; Stanley Martin Udale, Central Technical College; George Urquhart, University College; Joseph Stanley Westerdale, University College.

FOR EXTERNAL STUDENTS.

Pass.—Alfred Seabold Eli Ackermann, private study; Walter Jamieson, private study; William Rees Jenkins, University College, Nottingham; Arthur Percy Morris, Battersea Polytechnic and private study; William Norman Thomas, Manchester Municipal School of Technology and private study; Thomas Thompson, Heriot Watt College, Edinburgh, and private study.

Honours.—First Class: William Beckit Burnie, private study; Frederick Charles Lea, private study; Harold Percy Philpot, East London College and private study; Frederick Charles Prentice, University College and University College, Bristol; Walter Alfred Scoble, Royal College of Science and Central Technical College.

Second Class.—Malcolm Ramsay Atkins, University College and private study; Harold Douglas Creedy, Central Technical College and private study; Lawrence Wyld, University College, Nottingham.

Third Class.—Horace Malcolm Hodson, Finsbury Technical College and private study; William Neagle, Woolwich Polytechnic.

Honours Candidates recommended for a Pass.—George Henry Broom, B.Sc., Royal College of Science and private study; Stanley Steuart Elliott, Central Technical College and private study; Thomas John Ransom Kiernan, King's College; Cyril Benjamin Raphael Merton, Central Technical College, Berlin Technische Hochschule, and private study.

THE ACTION OF CAPPED ARMOUR PIERCING SHELLS.

By Eugen Kodar v. Thurnwerth.

THE explanation of the action of capped projectiles that follows, possesses only a hypothetical value, but it so closely fits the facts as they are known that a preference may be given to it in view of the defects in the theories which have from time to time been put forward.

The action of the projectile against hard plates is unsatisfactory because the great pressure per square inch that is brought to bear on the point causes the breaking up of the projectile. A certain amount of flattening of the head from this point of view should be looked upon as advantageous, for the greater the surface that bears the pressure the less pressure is there per unit of surface. Tests that have been made show, however, that on account of the increased difficulty of penetration, a flat-headed projectile does not give better results than a pointed one. Hence the construction of capped projectiles has been resorted to, for this diminishes the pressure on the unit surface, while at the same time the advantage of a point in the penetration of the plate is not surrendered.

The superior action of the capped projectiles rests therefore on the fact that the point of the projectile is not deformed at the first instant of impact with the plate. Due to the presence of the cap, the pressure is not confined simply to the point, but is distributed uniformly over a fairly large cross-section. The unit pressure therefore does not exceed the limit above which the choice tempered material of the projectile would be impaired. As a consequence the point is not deformed at the first instant of impact but pierces like a chisel into the hard layers. This work will be so much the easier for the projectile, since the "material cone" * formed in the plate due to the cap will already have begun the destruction of the outside diamond-hard surface layer of the plate, which is not more than a few millimetres thick.

At this stage the cap has already fulfilled its mission, and the projectile goes on its way through the plate alone and uninjured. The following process now occurs: The point having once entered the exterior hard layer, forms a path for itself in this portion of the plate by its ever-widening head forcing aside the particles in its front, their cohesion having been already disturbed by the formation of the

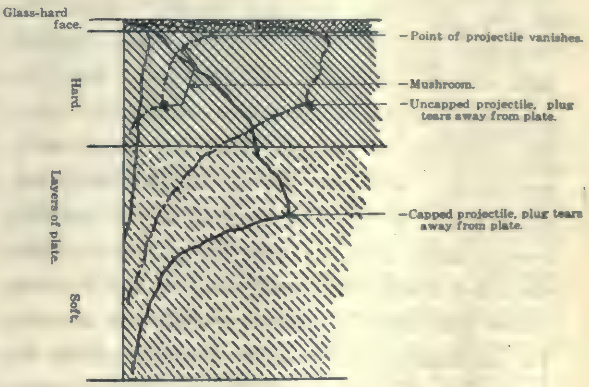

Glass-hard face.
Hard.
Layers of plate.
Soft.
—Point of projectile vanishes.
—Mushroom.
—Uncapped projectile, plug tears away from plate.
—Capped projectile, plug tears away from plate.

FIG I. ILLUSTRATING THE ACTION OF CAPPED AND UNCAPPED PROJECTILES.

According to the theory of Prof. Fr. Kicks there forms under the working surface of the tool in compression a thick conical shaped body in the material worked, which faciliatates deformation and splitting The existence of this material-cone is readily detected by means of plates specially prepared. In pressure tests with very brittle material (sandstone) the material-cone breaks directly out of the body tested.

"material cone." On the front of the plate there is a crumbling characteristic of hard metal. Where the hard metal layers pass into the softer ones this crumbling no longer occurs on account of the greater tenacity of the latter. The perforation now narrows to dimensions not much greater than the calibre of the projectile. It might be thought that the further progress of the projectile would resemble the perforation of soft homogeneous steel plates. This, however, is not the case, for the qualities of steel intended for hardening differ very materially from those of unhardened steel. The material that the projectile now meets is less tenacious than homogeneous unhardened steel, so that a cylindrical section of the plate in front of the projectile is forced out like a stopper. After penetration, therefore, the back of the plate presents the appearance of a plate hardened throughout. The stopper of metal forced out of the plate is usually broken up into several pieces because the head of the projectile having passed through without injury, in normal penetration, this piece remains about the thickness of the calibre of the projectile. Hitherto no trace of the cap has been found. Probably it is driven radially on penetration, and broken up, so that its pieces mingle with the fragments of the plate.

The superiority of the action of capped as compared with uncapped projectiles rests, therefore, as stated, on the fact that the head of the projectile remains intact. With the ordinary projectile the velocity upon impact falls off so suddenly towards zero, that the pressure increases until it reaches a point where the cohesion of the metal of the projectile is overcome; with capped projectiles, however, on account of the distribution of the pressure over a larger area, the pressure per unit of area does not reach this limit, and it still remains below this limit in further penetration, because the hardened exterior layer is weakened by the formation of the material cone. The pressure curve for capped projectiles against hard plates will therefore resemble that for pointed projectiles against soft plates. At first, while the ogival head is entering the plate, the curve will slowly rise until the head has completely entered. When the stopper of metal breaks out of the plate, the curve will fall steeply, so that at this point it will show an angle. This curve represents the total pressure, for the pressure per unit of area decreases from the start because with the increase of the total pressure, the surface receiving it also increases.

On the other hand the pressure curve for uncapped projectiles resembles that for a flat-headed projectile. The total pressure rises rapidly, and maintains itself at about a constant height so long as the shearing strength of the plate at the place of impact is not overcome; once the plate is punched it sinks rapidly. The pressure per unit of area on the head grows rapidly from the instant of impact until the head as such disappears. The area included between each curve, the axis of abscissas, and the extreme ordinates, must be equal in each case, since this area represents the work done

It will thus be apparent that the problem of the capped projectile, remarkable as the results appear at first sight, is yet capable of an explanation on a simple mechanical basis. The transfer of the pressure from the surface of impact, the front of the cap, to the working cross-section of the ogival head takes place in a wave motion at an enormously high velocity, practically instantaneously, and the pressure may be regarded as completely and uniformly taken up, if the cap is firmly seated upon the projectile. A good solid attachment of the cap to the body of the projectile is therefore the weightiest factor in the construction of the capped projectile. In order that the transfer of pressure may properly be accomplished, the cap must be seated in the closest contact with the projectile's head throughout its entire interior surface. If this condition is fulfilled, it ensures that the cap will not part from the projectile either in the bore or in the air; the first might lead to accidents, the second to wild shooting. Such a firm and absolutely reliable attachment is only to be secured by means of metallic soldering. This method would also remove the defects due to any small room for play that might remain between the cap and the projectile after grinding. A solder suitable for this purpose must possess two qualities; first it must possess sufficient firmness, and secondly a low point of melting so that the tempering of the point will not be affected during the process of soldering. This requires that it should lie considerably below 200 deg. C. Now these two qualities are opposite, since ready melting usually goes with small firmness. Thus there are difficulties in the way of obtaining a suitable alloy, so that the method of soldering is not in general use.

The method of soldering has the advantage that projectiles on hand can be easily fitted with a cap, and in manufacturing new shell no regard need be paid as to whether they will or not be furnished with a cap. A great advantage of soldering in comparison with other means ordinarily employed to attach the cap, lies in the fact that by this process the head of the projectile is not weakened, as it is when grooves or channels are turned in the head. Ridges in the vicinity of the head have the disadvantage that they are liable to cause a cracking upon tempering. When grooves are turned into the head in the finished projectile, the exterior surface is injured, and it may happen that the hard outer layer already under tension may be broken by the strain from within. Not only may the head be cracked in this way, but the whole projectile may disrupt before it is ready to be used.

Another method of attaching the cap is to screw it on the head. Of course this method applies only to the new projectile before hardening.

As regards the material out of which the cap is made, it appears on the whole that there is more freedom of choice in this than would seem likely at first. The chief requirement is a proper amount of elasticity of compression (the materia must not be too soft), and a relatively large tenacity, so that the cap will not fly to pieces on impact with the plate.

Nor does it appear that the form of the cap has much effect on the results, since nearly every manufacturer chooses a different one. It is essential that the front of the cap should present a broad surface and that it should rest against a large cross-section of the head.

The greater the velocity the less important is the shape of the head. At the same time it is to be noted that the displacement of the centre of gravity towards the point influences favourably the trajectory, increasing both accuracy and range. Many tests by the Krupp firm confirm this fact respecting capped projectiles.

Besides the advantage that the capped projectile possesses over ordinary uncapped shell, in that its penetrative power is increased about 20 per cent., there remains to be mentioned the following advantage of the new type, namely, that the shell goes through the plate whole, or at the limit of its energy breaks into a few large fragments. This tends to increase the bursting effect very much. A satisfactory shell explosion can only occur when the shell arrives intact behind the plate. The use of high explosive preparations ensures a mine effect with capped projectiles, even when the inner cavity is small, and a result is produced much greater than that of uncapped fuzed shell that have a much stronger bursting charge.

Unfortunately, the value of the cap is not the same for all velocities. A pronounced superiority of the capped projectile compared with ordinary shell is only to be secured with high striking velocities. With low velocities, even when the capped projectile has sufficient energy to penetrate the thinner plate, the effect of both types is about the same. Hence at long ranges the capped projectile is no more effective than ordinary shell.

Abstract from "Mitteilungen aus dem Gebiete des Seewesens."

THE SOCIETY OF ENGINEERS.

VISIT TO G.W.R. WORKS, SWINDON.

A VISIT was made by the President, Mr. Nicholas J. West, and members of the Society of Engineers, on Wednesday, July 26th, 1905, to the locomotive and carriage works of the Great Western Railway Company, at Swindon, by kind permission of the chairman of the company, Mr. A. Baldwin, M.P. Arrangements for conducting the visitors over the works were made by Mr. G. J. Churchward, the locomotive and carriage superintendent of the company.

It was in 1861 that the rolling mills for the manufacture of rails were erected. From 1875 the quantity of rails manufactured was gradually diminished, the last lot having been rolled in steel in 1878. The mills have since been used for the manufacture of merchant iron, the average turn-out being from 160 to 200 tons per week.

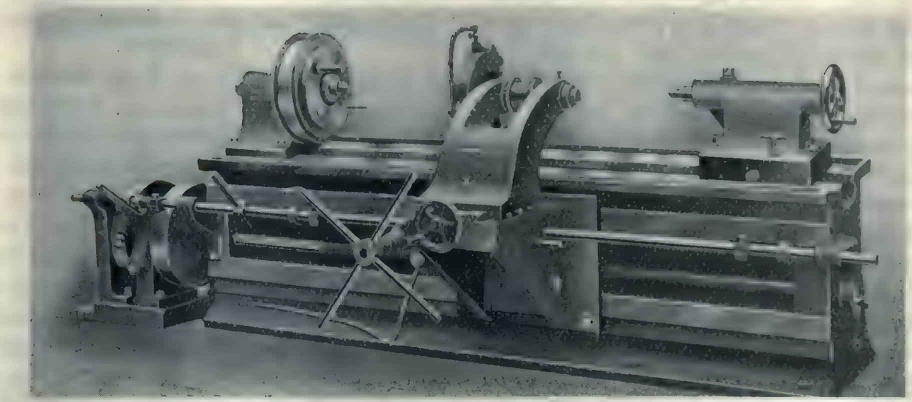
After the amalgamation of the West Midland Company with the Great Western Railway Company in 1862, it was decided by the directors that a central works for the construction of carriages and wagons should be provided. Some delay occurred in deciding upon the most suitable site for these works, Oxford being considered to offer some advantages as a centre for the work of this department. The ultimate decision was to erect the works at Swindon, and they were accordingly commenced in 1868, enlargements having been made from time to time to meet the increasing requirements. In 1873-4 new foundries were built, and other considerable additions made to the locomotive works. In 1902 a large erecting and machine shop was constructed, the dimensions being 486 ft. by 480 ft. The traversing tables and overhead cranes, as well as the machinery used, are electrically driven. Power is provided by three sets of vertical gas engines, direct coupled to electric generators working at 250 volts. The total area occupied by the works and yards is 254 acres.

In addition to the construction of the locomotive carriages and wagons required for the service of the company, a great variety of other work is taken in hand. Large quantities of castings are made for the signalling department, and a considerable staff is occupied in the construction and repairs of station furniture and fittings. The heavy repairs to the pumping machinery in use at the Severn Tunnel, and the hydraulic machinery in use at the various docks and stations of the company, are also carried out here. The greater portion of the carriage stock of the company is fitted with oil-gas lamps. Some of the coaches are lighted by electricity. Most of the stock is also equipped with steam heating apparatus, almost the whole of the work being done at Swindon. Rail and road motor-cars have been introduced in connection with the Great Western system with considerable success. To date fifty rail motor-cars and six trailers have been constructed at Swindon.

At the time of the change of gauge in May, 1892, with the exception of a few hundred wagons which were taken in at the Bridgwater workshops, the whole of the broad-gauge rolling stock was brought to Swindon to be converted or broken up. Thirteen miles of additional sidings were laid to receive this stock. The total number of broad-gauge locomotives was 195; of these 130 had been so constructed that they were readily convertible to narrow gauge. There were also 748 passenger train vehicles, and upwards of 3,400 wagons and vans, a large proportion of which had also been constructed with a view to conversion. This was especially the case with a number of the eight-wheeled carriages, which required only the changing of the bogies and the alteration of the footboards to transform them from broad to narrow gauge. On one occasion 25 coaches were so converted in six and a quarter hours by means of specially constructed hydraulic trap lifts.

The total number of hands employed in the locomotive department as on June 24th, 1905, was 8,422, and in the carriage and wagon department 5,063, making a total of 13,485. In addition to these about 750 men are employed in the traffic, stores, and permanent way departments of the company at Swindon.

The rolling stock owned by the company, on June 24th, 1905, was as follows: Loco. engines, 2,859; carriages, vans, etc., 7,403; goods vehicles, 67,203. In addition to these the company owns the undermentioned road vehicles: Omnibuses, 26; parcel carts, etc., 190; goods vehicles, vans, lorries, etc., 2,191.



IMPROVED PISTON-ROD GRINDING MACHINE.

AN IMPROVED GRINDING MACHINE FOR PISTON AND VALVE RODS.

BY MESSRS. HULSE AND CO., LTD., MANCHESTER.

WE illustrate above a grinding machine specially designed by Messrs. Hulse and Co., Ltd., of Ordsal Works, Manchester, for grinding the piston and valve rods of locomotives. It is suitable for grinding a piston rod with a 22-in. diameter piston head; the height of centres being 12 in., the maximum distance between centres 5 ft. 6 in., the maximum length to be ground 5 ft. 6 in., and the maximum diameter that can be ground, 12 in.

The slide bed about 9 ft. 9 in. in length is carried down to the floor, and is formed as a trough for lubricant. There are two headstocks, one fixed and having a pulley provided with Clement's driver for rotating the work on dead centres; and the other adjustable along the bed and with bolt and keep for securing it in any position, and provided with transverse slide for taper grinding. The carriage is traversed along the bed automatically in both directions through reversing pulleys, the machine being fitted with guide screw, and double clasp nut and quick hand traverse by rack and pinion. The travel of the carriage is varied and automatically reversed by means of adjustable stops and sliding rod operating a clutch between the reversing pulleys. The transverse slide mounted on carriage is provided with transverse adjustment for feeding the wheel against the work. The emery grinding wheel, 12 in. in diameter, is mounted on a steel spindle running in dust-proof self-lubricating bearings, and is driven by pulley on spindle. The machine is fitted with pump and connections for forcing the water on to the emery wheel; handles and screw-keys, etc. The countershaft has a long wood drum for rotating the emery wheel and three-speed cone pulley driving on to a second countershaft affording three different speeds for rotating the work and traversing the sliding carriage.

ELECTRICAL AFFAIRS.

It is very odd how new systems are frequently tried in the most unsuitable places. For example, the conduit system of traction was first tried at Blackpool, which was about the most unsuitable place in the whole world, because the sea came in after a high tide and filled up the conduit with sand. It is probable that if this conduit had been first experimented with in an inland town, under more favourable conditions, its development would have been much more rapid.

The stud contact system is another case in point. As is well known, it is being tried on a considerable scale at Wolverhampton, which happens to be the principal centre for the manufacture of stamped iron and steel articles. The result is that quantities of scrap are produced, and as this is carted along the streets from the various works, a certain amount falls out of the carts. It very frequently happens that these drop on to a stud and start a short circuit, in fact this has given more trouble than anything else connected with the system.

At the standard periodicity of 50 per second the speeds of multiphase motors are fixed at certain widely spaced values, which some consider a disadvantage. As a matter of fact, however, it is beneficial, for it enforces that standardisation which everyone is agreed is so highly necessary. For example, a multiphase motor, working at a periodicity of 50 per second, will run at 500, 600, 750, or 1,000 r.p.m. (less the slip), that is to say, just four-speeds between 500 and 1,000, A direct-current motor, on the other hand, can be made to run at dozens of speeds, varying a few revolutions at a time, thus 500, 520, 550, 580, and so on. One reason for these many speeds is the fashion of trying to dispense with gearing, belting, etc.; but, used in moderation, belting and gearing are eminently useful in the application of such an essentially high-speed apparatus as the electric motor to the machinery. Admitting this, it follows that there is no great disadvantage in multiphase motors running at a few standard speeds.

For several years the writer has lectured in the evenings on electrical engineering to advanced students, and it may be of general interest to readers to know that there has been a pronounced improvement in the type of student attending such classes. Several years ago the writer had to commence by explaining the working of the slide rule; now the bulk of the students have slide rules of their own. Again, it was necessary a few years ago to start off with the elementary principles of dynamo design; now the students come to the classes with an excellent grounding in this part of the work.

NAVAL EXPENDITURE.

CRITICISMS BY THE COMMITTEE OF PUBLIC ACCOUNTS.

In a fourth report from the Committee of Public Accounts, issued on Wednesday, the Comptroller and Auditor-General calls attention to the fact that certain payments were made to contractors by the Admiralty in anticipation of the signing of contracts, and that these payments during the years 1902–3 and 1903–4 amounted to about £89,000 and £494,000 respectively. The Solicitor of the Treasury has expressed an opinion to the effect that a guarantee on the part of the contractors to sign a contract when called upon did not protect the Admiralty. The reasons for doing this were the difficulties in settling the form of the contracts and arriving at a specification which was agreeable to both parties. and to the Law Officers. The form of contract has now been settled, and "the Committee are glad to learn that this very irregular practice will be discontinued in the future."

A question arose upon the Admiralty entering upon a contract by which the sum of £50,000, voted for Chatham Dockyard Extension, would be exceeded to the amount of £20,000. It was entered into by the Director of Works without referring to the Accountant-General, and approved by the Admiralty, without the sanction of the Treasury. The Admiralty had told Parliament that a total sum of £4,500,000 would be required for this work, and placed plans in the House of Commons. Under these circumstances they did not deem it necessary to go to the Treasury before extending their liability. The Committee express the opinion in this report that, in so doing the Admiralty were mistaken, and that they had no power to exceed the £50,000 mentioned as a token sum. They add that both the Treasury and Comptroller and Auditor-General concur in his view.

The Committee point out that no less than £160,000 was spent on the refit of vessels now about to be sold as of being no further use to the Navy. They further report that the refits had not added much to the value of the ships, because they are not sold for commercial purposes, and fetch little more than the price of old iron. They say they "cannot too strongly condemn so extravagant a policy." They further comment on the fact that the refits of the various vessels referred to were not placed in the Estimates at all, and no provision made for them. Finally, the Committee emphasises the opinions expressed by them in previous reports, that if there is any departure of an extensive character from the Naval programme it should be at once reported by the Admiralty to the House of Commons.

THE DEVELOPMENT OF THE EDISON INCANDESCENT ELECTRIC LAMP, 1881-1905.

BY J. T. MARSHALL.

(*Continued from page* 188.)

JOINTS.

THE joint made in 1881 is shown in fig. 6, A to C inclusive,—A, with short pieces of copper wire welded to the platinum wire; B, with the wires bent over hook-shape and flattened on an anvil with a blow of a hammer; C, with the flattened hook bent over on itself enclosing the filament and with the joint copper plated. The plating was necessary because the folding of the flattened wire over the shank of the filament made a bad mehanical joint. The plating was done in a wooden trough, having holes in the bottom in which were placed perforated rubber corks, through which the tube of the stem fitted so as to make a water-tight joint. The wires at the bottom of the stem below the trough were all connected together electrically to one pole of a battery, and there was a grid of copper in the bottom of the trough connected to the other pole of the battery. The trough was filled with a sulphate of copper solution, and the stems were slipped in the perforated corks until the liquid came the proper height on the clamps, and the plating was continued until the proper thickness was attained.

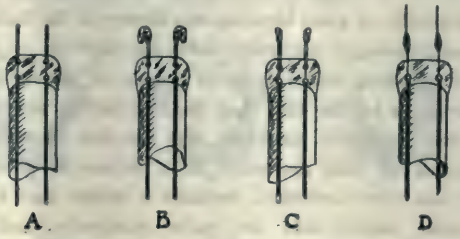


FIG. 6.

Plating was a very cumbersome, and expensive operation, and was soon superseded by the paste joint, as shown in fig. 6, D. The paste as first used was a mixture of very fine graphite, Chinese ink, and water. This answered the purpose pretty well, but the joints were not as strong as desirable, and there were certain ingredients in the binding material of the ink which caused a discoloration of the bulb, so that this clamp was afterward superseded by one containing certain proportions of graphite and gum, and this is the kind of clamp used at the present time. Since the time the paste clamp was adopted, the clamping has been done by daubing a small quantity of paste on both the platinum wire and the end of the filament, and sticking the two together. This was the method when paste was first adopted, and it is still the method; that is, it is one of the operations in which we have practically made no improvement in the last fifteen years. The bulbs, as heretofore stated, were first made free blown, so that no two bulbs were the same size and shape.

MANUFACTURE OF THE BULB.

Fig. 7 shows the bulb in the different stages of manufacture. A, just as received from the glass works; B, with the tip drawn or punched on the top, to be cut off as indicated on the dotted line so as to leave a small hole; C, with the short glass tube attached to the top, and with the neck blown off for the reception of the stem.

In the early stages of lamp manufacture the bulbs were sent to the operators who sealed the stems into them in just the condition that they were received from the glass works, except that they were washed. The operator heated a small spot in the top of the bulb, stuck a stick of glass into the heated part, and pulled out a slight point, which he cut off with a file. This left a hole in the top of the bulb. To this hole he joined a short piece of tubing through which the air was subsequently to be exhausted from the bulb.

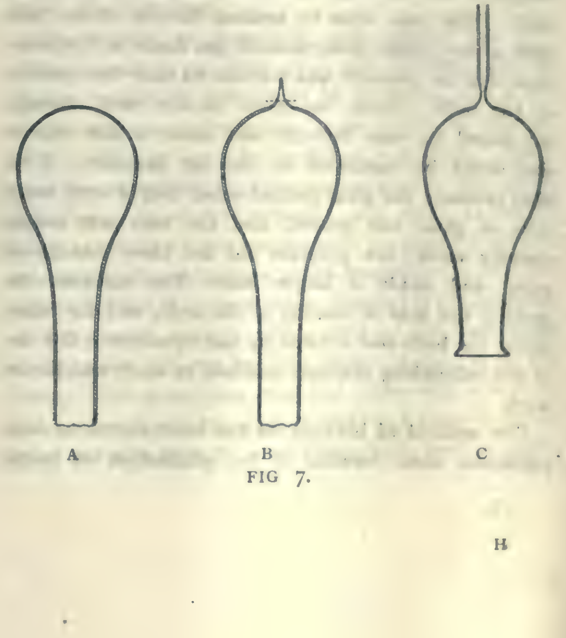


FIG 7.

Then he picked up one of his stems, and by comparing it with the bulb he saw the length that the bulb should be cut. He cut off this bulb by rotating it in the fire at the proper place, pulling off the neck and blowing out the melted end. Then he sealed the stem and bulb together as previously described, attached little glass prongs just below the joint of the stem and bulb to serve as anchors to hold in the plaster of the base, and cut off the stem below the joint.

It was soon found advantageous to divide the operations of tubulating the bulb and sealing the stem into the bulb among two operators, one of whom did the tubulating and the other the sealing-in. It was further found advisable to punch the little tip in the top of the bulb before sending it to the tubulator. This was done on a machine which held the bulb in a vertical position, neck up, over a gas flame which heated a spot in the top of the bulb. A pointed punch was then brought down through the neck of the bulb which pressed the tip out. After these operations had been separated for some time, they were again brought together by supplying each operator with a bulb-punching machine, on which one bulb was being heated while another was being tubulated, and in which the punch was operated by the foot.

For many years the small top tube was joined to the bulb by hand, but for several years the tubulating has been done on a little machine on which the bulb is held vertical mouth downward, and the short piece of top tube is held just over the hole in the top of the bulb, so that four small flames were directed on the point of juncture at the same time that the bulb and tube are slowly rotated. When the two are melted together, the point is stretched a little so as to produce a contraction, as shown in the figure. At the same time that this machine was designed, a machine was designed for making the hole in the top of the bulb. This was done by heating the top of the bulb with a very small sharp-pointed gas flame at the same time that air pressure was introduced into the interior of the bulb. When the glass became soft enough, air forced its way through and made a hole, whose size could be regulated by the air pressure. With high pressure the glass yielded when only a very small area of glass was heated, and the hole was consequently small; low pressure did not blow through so soon and made a larger hole. The machine for making the hole in the top of the bulb, and for tubulating the bulb was worked by one operator. The use of the tubulating machine resulted in more and better work.

The method of blowing off the bulb suited to each particular stem resulted in the production of lamps which varied considerably in length from the bottom of the base to the top of the bulb. It also resulted in a great difference in diameter where the base was attached to the bulb, so that there was always a compromise between making bulbs to fit the base, and making bases to fit the bulbs. With the advent of the tube stem it was found that the bulb could be made to fit the base better by blowing it off about one-half inch below the point where the diameter of the neck was the same as the diameter of the shell, and bulbs were gauged out into different lots according to the length from the top of the bulb to the point where it was the diameter of the shell, and different length bulbs were used for different candle-power lamps.

THE DEVELOPMENT OF GLASS-BLOWING MACHINERY.

Soon after the bulbs began to be gauged in this way, a machine was designed for blowing off the necks of the bulbs before they were sent to the sealers-in. This machine rotated the bulb rapidly in a horizontal position, and had guides which brought the bulb in the proper place to be blown off correctly. Later a blowing-off machine was devised, which held the bulb in a vertical position, neck downward, and at the same time rotated it in the fire. When the glass was sufficiently heated, the weight of the neck caused it to drop off, and at the same time air pressure was introduced through the top of the bulb, and blew off the film of glass which naturally formed over the mouth. This latest blowing-off machine is placed opposite the sealing-in machine, so that the same girl operates both.

The force of habit is very well illustrated in the development of glass-blowing machinery at the factory. A hand operator naturally holds his work in a horizontal position, and this habit seems to be the only explanation for the fact that the first flaring machines, the first sealing-in machines, and the first blowing-off machines all held the work in a horizontal position. This was very awkward, because a holder had to be provided, which held the parts positively, and the tendency of gravity was to get the work out of symmetry. When machines were devised which held the work in a vertical position it was only necessary to drop the part on holders, where they tended always to assume a symmetrical form. It now seems strange that anyone should have attempted to perform these operations in any other position.

In speaking of the stem tube, mention was made of the fact that a machine was designed which held the bulb and stem in position and rotated them in the fire while being sealed together. As this machine held the work in a horizontal position, it was not easy to get a holder for the latest type of stem, which would fit all of the stems. Glass tubing is made now in the same way as it was many hundred years ago and it is not possible to make it uniform in diameter. Hence the necessity of making a holder which would fit all diameters of tubes. The difficulty of doing this is probably what first suggested holding the stem in a vertical position and a machine was devised very similar to the machine used for making stems; in fact, it was used before the stem-making machine was developed. The four holders are adapted so that the stem is set on a stud which runs up inside of it and the bulb is slipped over the stem with the filament on it and rests on a holder so that the neck of the bulb and the flare of the stem are in the proper relative positions. This is done in the first position of the holder. In the second position, a soft flame is directed at the place where the joint is to be made. In the third position the two are melted together in a hot flame and in the fourth position the lamp is removed from the holder.

The desirability of having bulbs uniform in size was apparent very early, in the history of lamp manufacture, and from time to time bulbs blown in moulds were tried. With the earlier type of stems it was found that the number of cracked seals was very much increased, and so free-blown bulbs were used for a long time after we wished to abandon them. When the latest type of stem was adopted, it was found that they could be sealed into moulded bulbs with very little breakage, due to the different character of the joint, and the moulded bulb was adopted, and has been in use for about fifteen years.

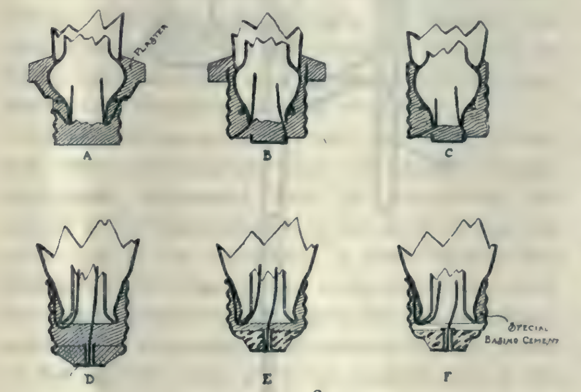


FIG. 8.

In fig. 8 are shown the different stages of development in the base—A, with the ring and shell assembled with plaster; B, with the cap and shell assembled with plaster; C, with the rim of plaster left off at the top. D, with the shell and cap assembled with porcelain, and attached to the lamp with plaster E, assembled with glass, and attached to the lamp with plaster; F, assembled with glass, and attached to the lamp with a special basing compound.

In A, B and C the brass parts were placed in a mould, which was then filled up with plaster of Paris, mixed thin enough to be poured. The lamp was set into it and allowed to stand until the plaster hardened. The thick rim of plaster at the top of A was necessary in order to make the plaster strong enough to hold the rim. It was soon found that screwing the lamp into the socket put a tensile strain on the plaster, and easily broke it apart. For this reason the base made with the cap on the bottom instead of a ring at the top was substituted. Screwing this base into the socket caused compression instead of tension, which the plaster was better able to sustain. At first this base had the thick rim of plaster at the top, not because it was necessary for strength, but because the shells did not fit the neck of the lamp, and it was thought to present a better appearance. Later the rim was abandoned, and this left some exposed plaster between the shell and the neck of the lamp. Very often the lamp was not set centrally in the shell, and this presented a bad appearance. To overcome this, the shells were turned in at the top to different diameters, and the lamps were sorted out to fit the different diameter shells. Later when the tube type of stem was adopted, it was found that the bulb could be blown about one-half inch below the point at which this diameter was the same as that of the top of the shell, and shells were afterwards made turned in all to the same diameter. This enabled us to use one type of shell, but it resulted in a still greater variation in the length of the lamp from the cap to the top of the bulb. All of this trouble was corrected when the moulded bulb was adopted, because the bulb was moulded with a shoulder, under which the top of the shell fitted.

The method of assembling with plaster was very slow, because it required about one half-hour for the plaster to harden sufficiently to be taken out of the mould, and one operator had to use about 100 moulds, so that the floor space required was very great. There were also objections to plaster on the ground that it had a tendency to absorb moisture, and when in use in moist places there was occasionally a current from one wire to the other in the base, which gradually ate away the wire and broke the connections. This led to the adoption of the present method. This involved the assembling of the screw and cap together before placing it on the lamp. This assembling was first done with a sort of vulcanite composition, afterwards with a piece of porcelain, and still later by assembling with molten glass.

The operator now picks up the base, and smears into the inner edge of the shell a quantity of the basing compound sufficient to fill up the space between the shell and the neck of the lamp. Then she threads one of the leading-in wires through the hole in the cap, and shoves the base down on the lamp, adjusting it by eye so as to be symmetrical. Then she places it base up in a furnace, in which the compound is heated up to melting point so that it adheres firmly to both the base and the lamp. The protruding wires are then cut off and soldered respectively to the shell and cap. The soldering is done by putting a little soldering paste on the wire where it touches the cap, and holding it up against a thinned pointed rod of copper heated by a gas flame. The method of soldering is practically the same as it was in 1881; that is, it is one of the few operations in which practically no improvement has been made.

So far, visible elements of the lamp have been considered, and little or no attention has been paid to three very important processes—viz., carbonisation, exhaustion, and testing.

CARBONISATION.

Our present method of carbonisation applied to the bamboo filaments of 1881 would probably not make them any better than they occasionally were, but it would make them all as good as the best. The improvement in carbonisation has been mainly in the line of increasing the production, at the same time that it has resulted in a much more uniform product. The important things in the carbonisation are to keep the air away from the filaments, so that they will not oxidise, and to raise the temperature so slowly that the volatile constituents of the filaments shall not be expelled so rapidly as to cause fracture in their structure.

At first filaments were carbonised in little nickel forms which were nothing more than extremely shallow boxes stacked up one above another in plumbago crucibles, so that each box served as a cover for the one just below it, and each box contained but one filament. Nickel forms did not permit of high enough temperature without being destroyed, and similar carbon forms were soon substituted. Later, when shankless filaments were used, deeper boxes were substituted for the forms quite a large number of filaments were placed in them, and the boxes were filled with a packing material to keep the filaments in shape.

Squirt filaments at present are packed without forms in cubical crucibles. A layer of these bunches is placed in the bottom of the crucible and covered over with a packing material, such as sawdust, or similarly finely ground substances; then successive layers are put in until the crucible is full. The purpose of the packing material is to hold the filament in place and shape. Carbonising results in a cubical block sufficiently tenacious to hold together, but friable enough to be easily broken apart to get out the filaments. It will readily be seen that by the modern method of packing, many more filaments can be put in a crucible than when they were packed in forms, one filaments in a form.

At first carbonisation was done in a brick furnace, burning coal with artificial draft, but later a preliminary heating was given in a cook stove. Still later, gas furnaces were used, one type for the preliminary heat, in which a dull red was obtained and another for the final heat, which brought the temperature to about the melting point of platinum.

EXHAUSTION.

In 1881 and until 1895, all lamps were exhausted on Sprengel pumps, as shown in fig. 9. Mercury from a reservoir flowed down through a contraction (a)

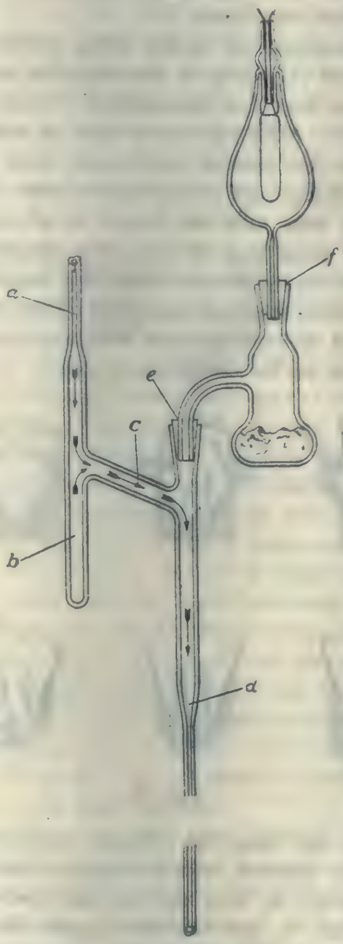


FIG 9. SHOWING EXHAUSTION OF LAMP ON SPRENGEL PUMP.

which limited the amount of flow, into the tube (b), which served as a cushion for the dropping mercury and ran across the tube (c) into the tube (d). This tube, a short distance below (c) was of smaller bore, so that as the mercury came down it trapped bubbles of air which it carried along to the bottom of the tube where it escaped. At the joint (e) a phosphorus cup was connected, in which was placed a small quantity of phosphoric anhydride, and at the joint (f) the top tube of the lamp was inserted. The purpose of the phosphoric anhydride was to absorb water vapours in the lamp. It took from one quarter of an hour to five hours to exhaust a lamp with such a pump. As good vacuum, and consequently as good lamps, can be obtained from a pump of this kind as from any of the more recent pumps, but as a matter of fact, through no fault of the pump, large numbers of poor quality lamps were produced in the early history of lamp manufacture, because there are many details in the process of exhaustion which require most careful attention to produce good results. For quite a number of years after we began the manufacture of lamps we alternately made good and poor lamps without knowing it, and the peculiarity of these poor lamps was that they gave longer life than the good lamps. This was because the condition of the vacuum was such that it changed in the early life of the lamp and reduced the candle-power of the filament very much below the initial candle-power. At this low candle-power the filament could burn a very long time without being destroyed.

The use of mercury produced insanitary conditions Pumps were continually breaking, the mercury was spilled on the floor. In warm weather the air of the room was saturated with mercury, and the men after a time became chronically ill with it.

Mechanical pumps were tried from time to time but were not adopted until an Italian, named Malignanni, discovered that by introducing the vapour of red phosphorus into the lamp at just the right time in the exhaustion, a good vacuum was obtained by the combination of the phosphorus with the residual vapours in the lamp. The red phosphorus previous to tubulating, was painted on the inside of the top tube, and when the vacuum was at the right stage, the lamp was shut off from the pump, and the tube heated on the outside to vapourise the phosphorus, which then spread out in the lamp. The right stage of vacuum for the introduction of the phosphorus was indicated by the condition of a blue halo which appeared in the lamp when lighted to the right degree of incandescence while on the pumps, and the proper combination of the phosphorus and residual vapours showing that the vacuum had been obtained was indicated by the total disappearance of this halo. At this stage the little contraction where the top tube is joined to the bulb was melted off with a torch, and the lamp as a lighting device was practically finished.

By the old mercury exhaust a gang of four men attended to about 100 lamps. With the red phosphorus exhaust each operator has a pump, and exhausting one lamp at a time, can give each lamp the individual attention it requires to obtain the best results.

It is rather a remarkable fact that the red phosphorus method of exhaustion is not applicable to lamps of less than 30 volts, and these lamps, while exhausted on the same kind of mechanical pump as is used with the red phosphorus, require about ten minutes for the exhaustion. All lamps after exhaustion are tested for vacuum on an induction coil. If the vacuum is not good, Crookes tube effects are produced.

TESTING.

The early method of testing a lamp for volts consists in putting it on a photometer with a rheostat connected in series with it, and on a voltmeter connected around it, bringing it to 16 candle-power by means of the rheostat, and reading the meter. To get accurate results a very constant source of current was necessary, and this was obtained by hand regulation of the field magnets of the generator. The man who regulated the voltage was placed near the photometer, and called out whenever the voltage was wrong, so that readings should not be taken at that instant.

A photometer whose accuracy did not depend on the voltage of the circuit being right was put in use about 1885. This is what is called the Sliding Scale Photometer, and is still in general use. This photometer is wired up with the lamps at each end of the bar in multiple, so that both have the same voltage over them, and the voltage of the lamp to be tested is determined by the position of the screen on the bar when in balance.

The calibration of the volt scale is made by taking a number of lamps previously tested on a standard

Type of Filament	Date	Watts per Candle	Actual Life Hours	Life of 80 % of Initial Candles Hours
Plain Bamboo	1881	5.8	3000	
”	1881	4.66	900	
Asphalted Bamboo	1888	3.1	1000	700
Treated	1893	3.1	1200	260
” Squirt	1896	3.1	700	370
” ”	1900	3.1	750	425
” ”	1904	3.1	800	475

FIG. 10.

photometer, and selected for each voltage from, say 100 to 120 volts, selecting a lamp of about the middle of this range for a standard to be used permanently at one end of the photometer, and placing the other lamps in turn on the other end of the photometer. moving the screen to a position of balance, and marking on the scale opposite these positions the corresponding voltages of the lamp. The principal advantage of this photometer is that fluctuations in line voltage do not affect its accuracy, because they affect both lamps in the same proportion, and do not alter the position of balance. The production is also increased through not having to read voltmeters and indicators.

Perhaps the element which has contributed as much to the improvements of the lamp as any other is inspection. Inspections have been gradually instituted all along the line of manufacture, so that at present we make from first to last fifteen inspections, in each of which from five to six defects are sought for.

Fig. 10 is a table showing the change in the life of the lamp coincident with changes in its elements and the method of its manufacture. The later improvements, corresponding to different periods, were obtained, not by elemental changes in the lamp, but by a very gradual improvement in the processes. When the importance of maintenance of candle-power began to be appreciated, it was necessary to decide at what percentage of its initial candle-power a lamp was no longer useful and would better be taken down and destroyed rather than be allowed to burn longer. This point has by common consent come to be fixed at 80 per cent. of the initial candle-power.

It will be noted from fig. 10 that for the earlier lamps the life to 80 per cent. was not given. This is because we did not know the importance of ascertaining this factor, and did not suppose it was anything like so great as we afterwards found it to be. It will also be seen that as the life to 80 per cent. first began to increase, it was accompanied by a very decided decrease in the actual life. The previous long life as heretofore explained, was due to the rapid diminution of candle-power, and the consequent low temperature at which the filament burned. The 1896 lamp, although having a very much shorter life than the 1893 lamp, is really a much better lamp because of the longer life to 80 per cent. It has been the practice of the company from the beginning without any intermission to make life tests on lamps, both regular product and experiments.

In comparing the quality of lamps it is necessary to consider three items; candle-power, the energy consumed, and the life. Numerous tests have shown the comparative lives of lamps at different efficiencies, and in making comparisons we always calculate what the life would be at some given efficiency, say 3·1 watts per candle-power.

Watts	Life to 80% of Initial Candles Hours
32	28
40	132
48	412
56	1000
64	2005
72	3570
80	6125

FIG. 11.

Fig. 11 is a table showing the life we can expect from 16-c.p. lamps of different efficiency.

These lamps are all the same quality, and if burned at the same temperature would not vary greatly in life. The very great difference in life is due to the difference in temperature. The 80-watt lamp has four and a quarter times the surface of the 32-watt lamp, and the light per unit of surface, and consequently the temperature is very much less. Without going into a calculation, it will be evident at the usual prices of lamps and electrical energy that the 32-watt lamp, though taking little energy, will not be economical because of the very short life and consequent frequent renewals. On the other hand it will be seen that the 80-watt lamp, though having a very long life, will not be economical because of the large amount of energy used. Depending upon the cost of the lamps and the cost of electrical energy, the most economical lamp to use under a given set of conditions can be determined, and it is almost certain to lie somewhere between the extremes in fig. 11. In general, the higher the cost of the electrical energy and the lower the cost of the lamp, the higher the efficiency which should be selected.

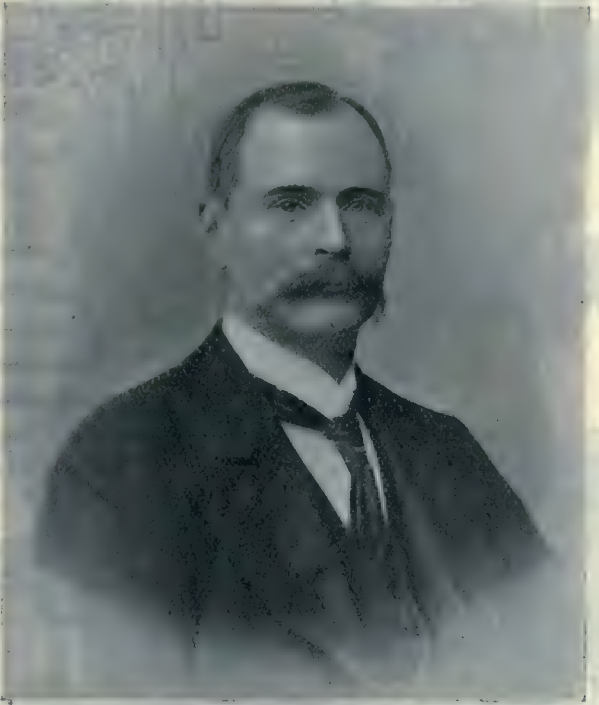
The 3·1 w.p.c. lamp at the time of its adoption was of too high an efficiency on account of the short life to 80 per cent. of initial candle-power. This was not then appreciated, but it is now. With the subsequent improvement in quality, the life became quite satisfactory. If some improvement in lamp manufacture should greatly increase the life that a 3·1 w.p.c. lamp can be made to give, it is probable that this improvement would be taken advantage of to make the lamp more efficient rather than to prolong its life.

Read before the Franklin Institute.

OUR WEEKLY BIOGRAPHY.

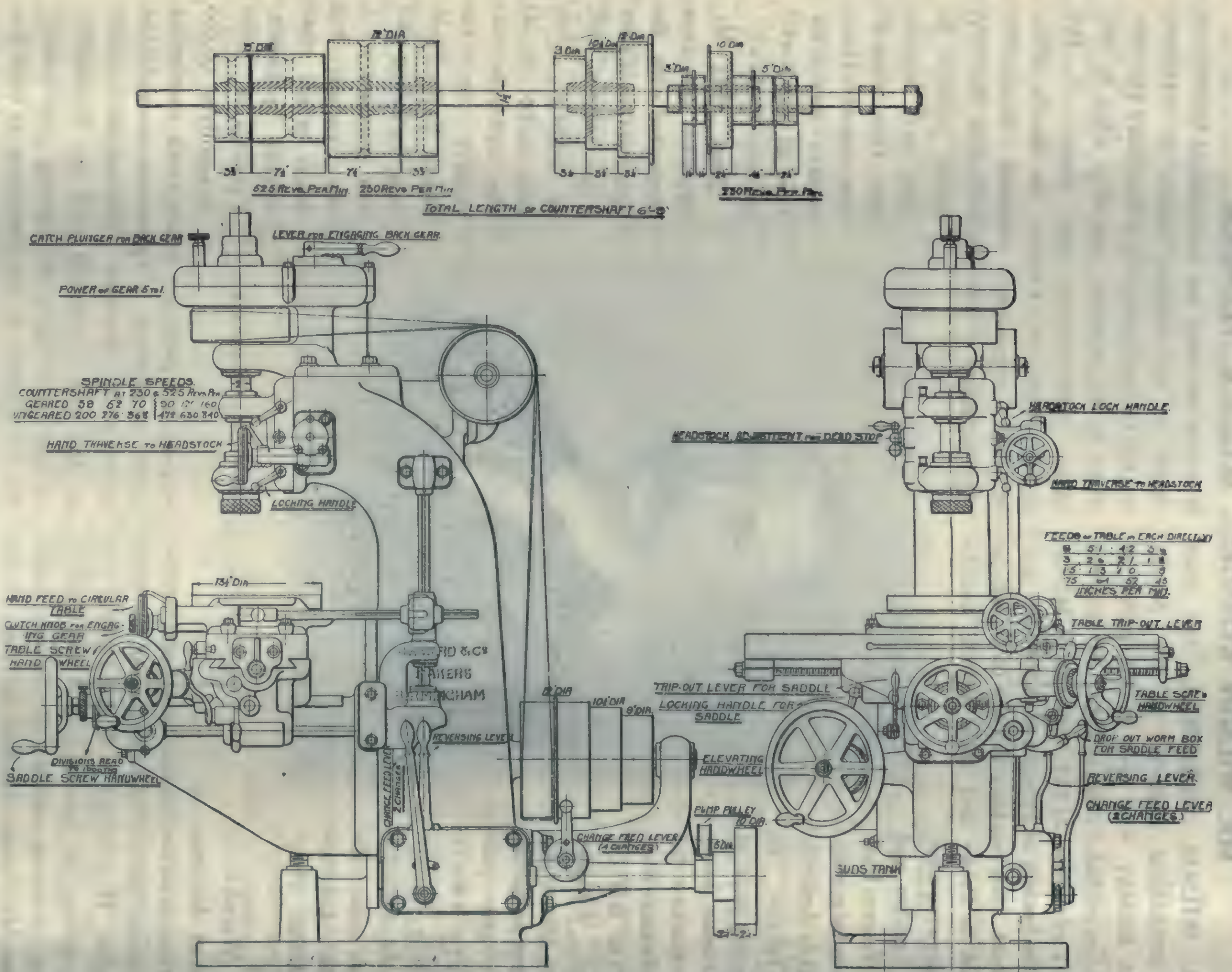
MR. WILSON WORSDELL, M.Inst.C.E., M.I.Mech.E.

MR. WILSON WORSDELL, the chief mechanical engineer of the North-Eastern Railway, was born in the parish of Church Coppenhall, Crewe, in 1850. He received his early education at the large school belonging to the Society of Friends, at Ackworth, near Pontefract. On reaching the age of sixteen he returned to Crewe and spent several months in the drawing office of the London and North Western Railway. In July, 1867, he went to America, and became an engineering pupil at the Altoona Locomotive Works of the Pennsylvania Railroad. The late Dr. Edward Williams, who was then superintendent of motive power and machinery there afterwards became one of the principal partners of the Baldwin Locomotive Works, Philadelphia.


MR. WILSON WORSDELL, M.INST.C.E., M.I.MECH.E.

Mr. Worsdell remained at Altoona, going through all the different branches of locomotive construction and maintenance for four and a half years. He returned to England in the year 1871, entering the London and North-Western Railway erecting shops at Crewe, under the late Mr. George Dingley, foreman of the new erecting shops. At the end of twelve months was transferred to the drawing office, where he remained two years. In 1874 Mr. Worsdell was sent out as assistant-foreman in charge of the running sheds, at Stafford. In 1876 he was transferred to Bushbury Junction where he was foreman until 1877, when he was again promoted to take charge of the engine sheds at Chester. In March, 1883, he was appointed assistant locomotive superintendent of the North-Eastern Railway, which position he held until September, 1890, when he was appointed locomotive superintendent of the North-Eastern Railway.

Since 1883 Mr. Worsdell has been connected with the construction of over 1,000 engines, and, in addition, has had charge of all the hydraulic machinery on the North Eastern system, including also the machinery of the various tug boats which that railway possesses. Upwards of 2,100 locomotives, 96,000 wagons, and passenger rolling stock numbering 3,850, in addition to 19,000 men, are under the control of Mr. Worsdell. This number includes all the men connected with the locomotive, carriage and wagon and running departments. He is a member of the Institution of Civil Engineers, of the Institute of Mechanical Engineers, of the North of England Mining and Mechanical Engineers, and of the Iron and Steel Institute.


12 DIA
12 DIA
3⅛
7⅛
7⅛
3⅛
525 REVS PER MIN
250 REVS PER MIN
1¼
3 DIA
10½ DIA
12 DIA
3⅛
3⅛
3⅛
3 DIA
10 DIA
5 DIA
2⅛
2⅛
350 REVS PER MIN
TOTAL LENGTH OF COUNTERSHAFT 6'-8"
CATCH PLUNGER FOR BACK GEAR
LEVER FOR ENGAGING BACK GEAR
POWER OF GEAR 5 TO 1.
SPINDLE SPEEDS.
COUNTERSHAFT AT 230 & 525 REVS PER MIN
GEARED 58 62 70 | 90 121 160
UNGEARED 200 276 368 | 478 630 840
HAND TRAVERSE TO HEADSTOCK
LOCKING HANDLE
13¼" DIA
HAND FEED TO CIRCULAR TABLE
CLUTCH KNOB FOR ENGAGING GEAR
TABLE SCREW HAND WHEEL
DIVISIONS READ TO 1000THS
SADDLE SCREW HANDWHEEL
WARD & CO MAKERS BIRMINGHAM
REVERSING LEVER
CHANGE FEED LEVER 2 CHANGES
12 DIA
10½ DIA
8 DIA
CHANGE FEED LEVER (4 CHANGES)
PUMP PULLEY 10 DIA
3 DIA
2⅛
ELEVATING HANDWHEEL
TRIP-OUT LEVER FOR SADDLE
LOCKING HANDLE FOR SADDLE
SUDS TANK
HEADSTOCK LOCK HANDLE
HEADSTOCK ADJUSTMENT FOR DEAD STOP
HAND TRAVERSE TO HEADSTOCK
FEEDS OF TABLE IN EACH DIRECTION
6 5·1 4·2 3·6
3 2·6 2·1 1·8
1·5 1·3 1·0 ·9
·75 ·64 ·52 ·45
INCHES PER MIN.
TABLE TRIP-OUT LEVER
TABLE SCREW HANDWHEEL
DROP OUT WORM BOX FOR SADDLE FEED
REVERSING LEVER
CHANGE FEED LEVER (2 CHANGES)

DETAILS OF NO. 2 VERTICAL MILLING MACHINE BY MESSRS. H. W. WARD AND CO.

24-in. by 9-in. by 15-in. VERTICAL MILLING MACHINE.

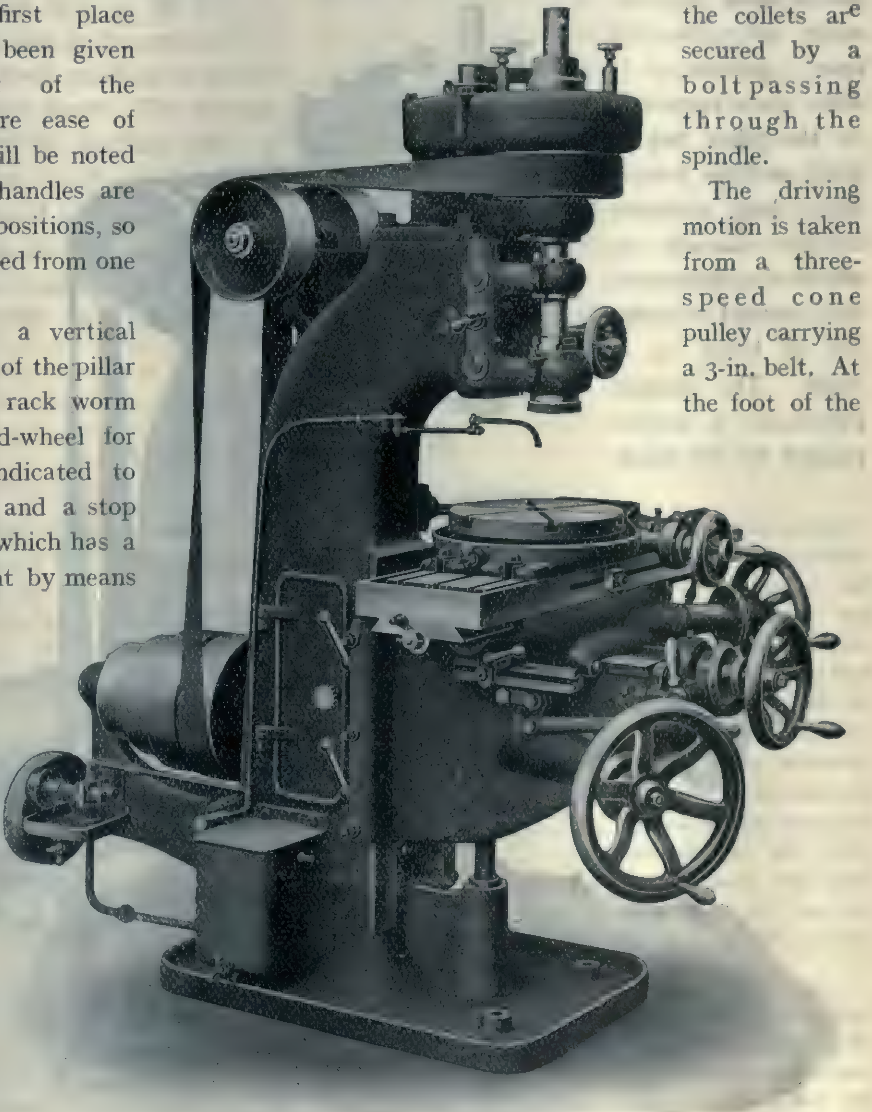
BY MESSRS. H. W. WARD AND CO., BIRMINGHAM.

WE illustrate on this and the accompanying pages a vertical milling machine built to a recent specification by Messrs. H. W. Ward and Co., of Birmingham. The machine embraces a number of interesting features of construction, embodying the latest experience of the firm. In the first place careful attention has been given to the arrangement of the various parts to secure ease of manipulation, and it will be noted that all the operating handles are placed in convenient positions, so that they may be reached from one place.

The headstock has a vertical adjustment on the face of the pillar of $3\frac{1}{2}$ in. by means of rack worm and wheel. The hand-wheel for operating this in indicated to read $\frac{1}{1000}$th of an inch, and a stop for depth is provided, which has a fine indexed adjustment by means of the small balanced handle on the left-hand side of the head. Two locking handles are arranged for clamping the head rigidly in position.

The spindle is 2 in. diameter on the driving part, and 3 in. diameter in the largest part of the lower neck. It is of steel, hardened and ground, and runs in gun-metal bearings, two on the moving head, and a third fixed bearing in the top box. The lower bearing is conical and the other two parallel. Full adjustments are provided for wear and thrust, this being taken on a hardened and ground steel collar. The spindle nose is bored to a No. 4 Morse taper, and the collets are secured by a bolt passing through the spindle.

The driving motion is taken from a three-speed cone pulley carrying a 3-in. belt. At the foot of the

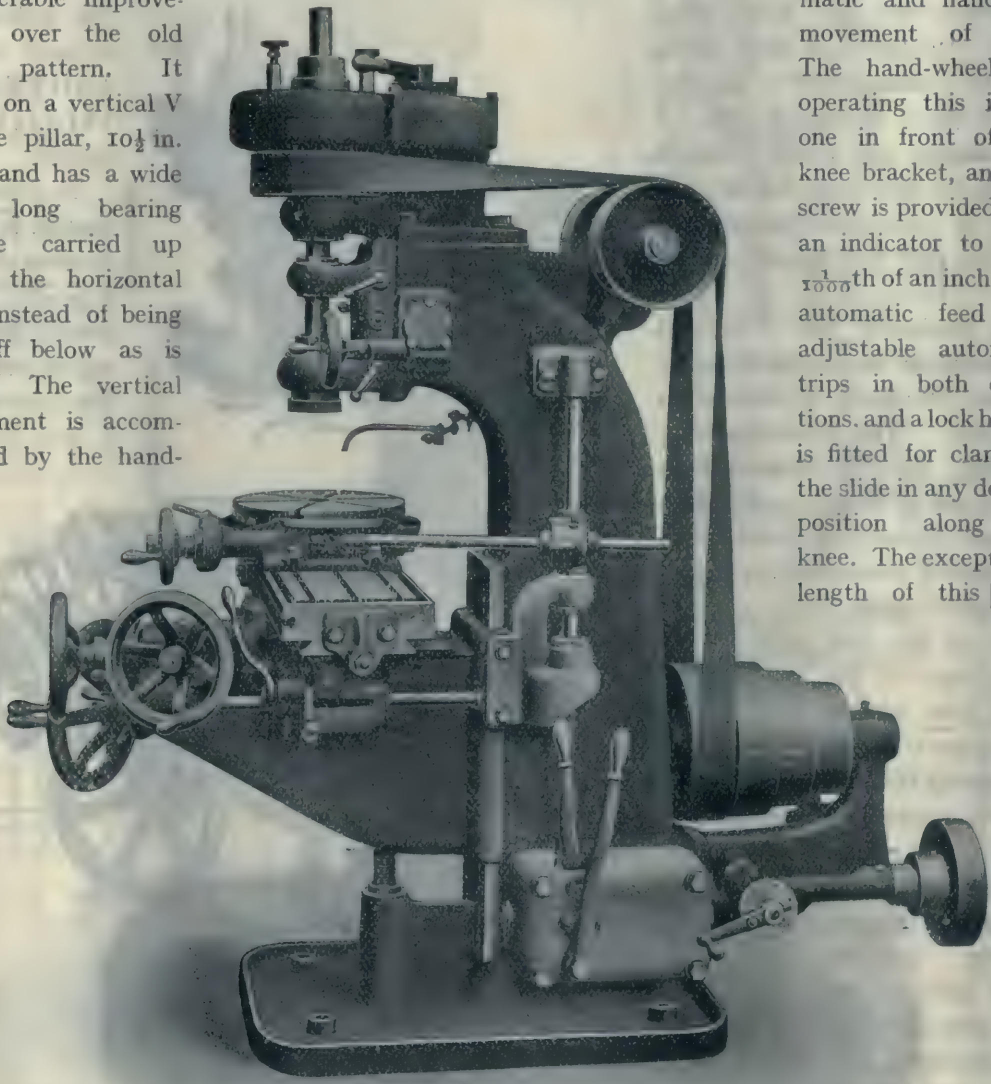


NO. 2 VERTICAL MILLING MACHINE.

machine by the side of this is a single pulley carrying a belt which drives up to the spindle pulley over two guide rollers. The spindle pulley runs on a fixed bush, so as to take the pull of the belt off the spindle. The gearing is of the power $5\frac{1}{4}$ to 1, and is machine cut and runs in a gear box, the back gear being provided with an eccentric movement operated by lever for throwing out of gear when not required.

The knee bracket is a box casting offering considerable improvement over the old open pattern. It slides on a vertical V on the pillar, $10\frac{1}{2}$ in. wide, and has a wide and long bearing surface carried up above the horizontal face instead of being cut off below as is usual. The vertical movement is accomplished by the hand-wheel at the left-hand side, through bevel wheels and screw, and a free adjustment is effected by taking the weight of the slides on a ball race on the screw. The elevating screw is telescopic which prevents the screw projecting below the level of the base of the machine, and thus obviates the necessity of cutting holes to pass the elevating screw, as in the ordinary type of elevating screw.

The middle slide is long, and has both automatic and hand-feed movement of 9 in. The hand-wheel for operating this is the one in front of the knee bracket, and the screw is provided with an indicator to read $\frac{1}{1000}$th of an inch. The automatic feed has adjustable automatic trips in both directions, and a lock handle is fitted for clamping the slide in any desired position along the knee. The exceptional length of this slide



ANOTHER VIEW OF THE MACHINE.

secures the trueness of the table in all positions.

The table is 3 ft. 7 in. long by 10½ in. wide over all, and has both automatic and hand-feeds. The handle for operating the table at the right-hand side of the machine, is indicated to read $\frac{1}{1000}$th of an inch. The feeds are driven independently by a two-speed cone pulley from the countershaft, and arrangement is made on the countershaft to automatically throw off the feed belt at the same time as the belt for driving the machine, so that in the event of any accident occurring the whole machine is at once stopped by moving the lever. The change-feed box is at the foot of the machine, and contains a reversing motion, applicable to all the feeds, and eight changes of feed operated in all by three levers, one for the reversing and one for giving an immediate change from a roughing to a finishing feed. The box carrying this change gear is arranged to carry a large supply of oil in which the gears, which are of steel, are constantly running. By drawing one shaft, and taking out four screws the box containing the whole of the gears may be removed intact for inspection.

The circular table is 13½ in. diameter, and is fastened to the table by four ⊥-headed bolts. It may be revolved by worm and wheel, either by hand or automatically, sixteen different rates of speeds being obtainable. A friction clutch operated by the knurled knob in the centre of the hand-wheel enables the automatic feed to be started or stopped immediately. The hand-wheel is indicated to read in degrees.

The countershaft is supplied with two sets of fast and loose pulleys, and an independent drive for the feed motions and oil pump, and arrangement is made for stopping both the main and feed belt by the movement of one lever.

NEWS ITEMS.

THE annual general meeting of the members of the North of England Institute of Mining and Mechanical Engineers will be held in the Wood Memorial Hall, Newcastle, to-morrow, August 5th. The following papers will be open for discussion: The Clarence R. Claghorn prize essay upon "The Action, Influence and Control of the Roof in Longwall Workings," by Mr. H. W. G. Halbaum; "The Action, Influence and Control of the Roof in Longwall Workings," by Mr. J. T. Beard. "The Action, Influence and Control of the Roof in Longwall Workings," by Mr. E. H. Robertson; and "Observations on Water-sprayed or Damped Air in Coal Mines," by Mr. James Ashworth. The following papers will be read or taken as read: "Determination of the Specific Electrical Resistance of Coal, Ore, etc.," by Mr. G. C. Wood, B.Sc; and "A Mechanical Coal-Cutter in Queensland," by Mr. William Fryar.

The London congress of the International Statistical Institute now in progress is remarkable for the fact that nineteen different countries are represented; and certainly the agenda is most comprehensive in its scope and character, including papers on the Economic Equilibrium of Nations, Industrial Censuses and Statistics of Trade Depression, International Comparison of the Wages of Workmen, Import and Export Statistics, International Transportation, and indeed statistical information on a vast array of topics. The Prince of Wales, in opening the congress, said that in future all branches of social science must look for their advancement to the continually improving character of the raw material furnished by statistics. National tendencies were now capable of increasingly accurate measurement with the aid of the numerous statistical tabulations which now existed, and every widening of the field brought in a more than proportionate harvest. For scientific progress the primary essential was active and effective co-operation among scientific workers in all countries.

The American shipbuilding statement for the fiscal year ending June 30th, which has been prepared by the Bureau of Navigation at Washington, reports that 800 vessels of about 150,000 tons, both steam and sail, were constructed in the United States. This is upwards of 25 per cent. less than the aggregate new tonnage output in the previous fiscal year.

IRON ORE DEPOSITS ABROAD.

POSSIBLE FIELDS FOR FUTURE ENTERPRISE.

(*Continued from page* 208.)

PORTUGAL.

MR. CONSUL COWPER (Lisbon) states that the information the British Iron Trade Association are desirous of obtaining could not, as far as his consular district is concerned, be answered in a reliable or practical manner, except by an expert mining engineer after prolonged local inquiry, investigation and prospecting in the various localities where the deposits exist.

In consequence of the glowing reports circulated in recent years in connection with alleged extensive iron ore deposits in the district of Southern Portugal, several syndicates in the United Kingdom have sent mining engineers to examine and report on these deposits.

There are numerous so-called iron ore deposits in the southern districts of Portugal, but none of them are of any value with the exception of two acquired and now being worked by British companies, viz. :—

(*a*) The "Monges Mine" in the Alemtejo district, now the property of Messrs. Baldwins, Ltd., of Landore, near Swansea; and (*b*) The "San Thiago Mines," worked by The Minerals, Ltd.

The ores of both these mines are similar in character, being a brown hematite and magnetic, running about 54 per cent. of metallic iron. Messrs. Baldwins, Ltd., have smelted these ores for some years.

With the exception of the two mines referred to, no iron ore deposits of any commercial value exist within this district, as far as can be ascertained; but at the same time it must be noted that the rural districts of Southern Portugal have been very imperfectly prospected in modern times, and there is no knowing what discoveries may not be made later on.

There are two deposits in the Oporto district: one at Moncorvo, administrative district of Bragança; the other at Rates, administrative district of Oporto.

The Moncorvo deposits are practically in the hands of Messrs. Schneider and Company (Creusot). It is reported that they are holding them in the hope of more practical results being obtained from the electrolytic system of extraction of the metal, as under other conditions the cost would be too great.

The Rates deposit seems to have been at one time much thought of; so much so that the railway line from Oporto to Povoa, when it was extended as far as Famaticas, was made to go near Rates, in the hope of facilitating the exploitation of this deposit, but it would appear that all attempts to sell the deposit have been fruitless.

ROUMANIA.

There is one deposit in the district of Dobrogea, twenty-five miles from Braila, which is the nearest port admitting ocean steamers. Mr. Vice-Consul Dundas says: "I am disposed to believe that it would be worth the while of the British Iron Trade Association to send an expert to this country, provided they desire to acquire fuller information. I would also venture to suggest that no exploration should be done, even on a small scale, until options have been obtained in proper and legal form, according to Roumanian law. It is highly desirable, if business is thought of, that a respectable local firm should be consulted."

RUSSIA.

In 1901 there were forty-eight mines working in Krivoi Rog, belonging to twenty-three firms, as against seventy-nine mines and thirty-five firms in 1900. The actual known area, containing deposits of the ore, is only 783 acres, of which 335 acres were being quarried, and thirty-nine mined in 1901. There were forty-six steam winding machines, seventy-three horse ditto, and one electric ditto, with fifty-five steam engines and eighty-three boilers, aggregating 1,590 h.p. in 1901. The number of miners employed was 2,959, and labourers 1,267. The deposits chiefly consist of specular iron, magnetic iron and red hematite ores. The bulk of the ore is in lumps, but some, especially Kolatchevski's, is in the form of powder. Taking the whole of the region, the percentage of metallic iron fluctuates between 50 and 68 per cent. The average may be taken as 60 per cent. Most of the mines are owned or rented by metallurgical companies, which supply the ore to their own works, and naturally they would only sell at enhanced prices, but private concerns could, no doubt, be obtained at reasonable rates.

Of the total output of iron ore in South Russia, 94 per cent. falls to the share of Krivoi Rog, 3·5 per cent. to Kertch, and the remaining 2·5 per cent. to Donetz ores.

The ore is principally worked out of open quarries, which have a maximum depth of 280 ft.; the earth covering is small (14 to 70 ft.), and the seams of ore run from 35 to 75 ft. deep, although in some parts even 280 ft. seams are met with. Where the seams are shallow (5 to 20 ft.), and the covering large, or where the upper seams have already been worked to a considerable depth, then recourse is had to underground work. In 1902 this latter method of extracting the ore was only to be found at ten mines, occupying about forty acres of land, whereas open quarries accounted for about 335 acres.

Generally speaking, the mode of working the ore is very primitive; the cover is always removed by manual labour, with spades, and only in two instances were steam excavators employed. The ore is raised to the surface by means of inclined planes or shafts. There are in all one hundred and twenty elevators, of which forty-one are worked by steam, six by electricity, and seventy-three by horses. On the inclined planes where steam or electricity is used, from 300 to 800 wagonettes, each carrying one to one-and-a-half tons, can be brought to the surface each shift, but where horses are employed, the quantity per shift does not exceed one hundred one-ton wagonettes. It is computed that the Krivoi Rog deposits are still capable of yielding a total of over 80,000,000 tons of ore.

The Kertch Metallurgical Works have obtained from that town a special licence for thirty years, but the works have been now closed, having stopped payment. All the necessary means for recommencing work are in good and workable condition. The creditors were to sell the works by public auction for 17,000,000 roubles.

SERVIA.

Servia is rich in iron ore, but the deposits are practically untouched. The absence of good coal and want of capital has hitherto prevented any regular attempt to exploit this branch of the mining industry, especially as the treatment of the ore is complicated by the admixture of a large proportion of sulphur. Want of research prevents the full value and extent of the various deposits from being definitely known. The most important deposits are said to be those of magnetic iron present in the crystalline earths. All the mineral wealth of Servia belongs to the State, from which concessions for the working of the deposits must be obtained. The only concessions granted at present for the working of iron ore are for the deposits at Metaruge and Guberevatz—Ralja—both about thirty kilometres from Belgrade. The owners of these concessions have not means sufficient for the working of the mines, and would be glad either to come to terms or sell outright.

It is difficult to define the obstacles which nearly all foreign companies, who have hitherto obtained concessions in Servia, have to contend against. Jealousy on the part of the Servians towards foreigners who make money in the country, is a source of many difficulties, which are usually only to be solved by the Turkish system of "backsheesh," the desire for which is often the cause of their origin.

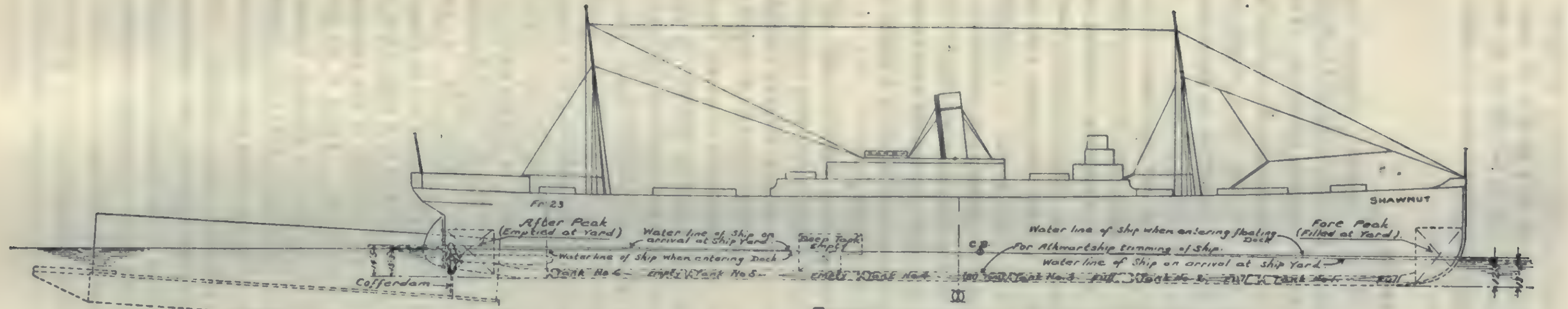
SPAIN.

In the Barcelona district deposits situated on the border of the provinces of the Barcelona and Gerona are reported to be worthy of serious attention. The owners of these mineral properties are mostly well-to-do people, some even rich, but most of them would, it is thought, be ready to sell the properties on fair terms for cash, or on the basis of receiving a royalty.

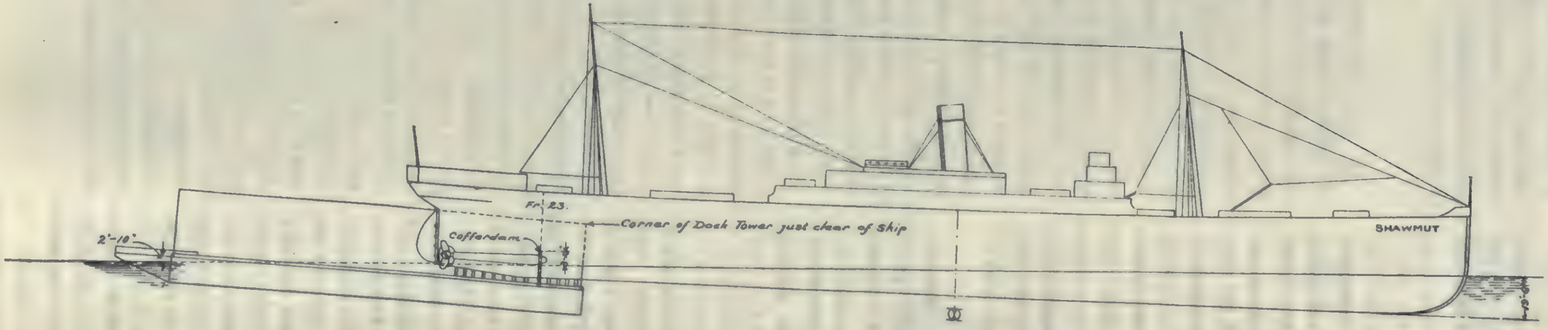
Innumerable deposits of iron ore are reported to exist in the province of Tarragona, but there are two special obstacles in the way of successsful working in the Tarragona district; first, the assumed poor quality of the ore; and, secondly, the great cost of transport, owing to want of good means of communication with the hill districts. Mining claims are continually being notified in the Government office, but no one as yet has ever seriously prosecuted this claim, it having become merely a practice to notify a claim in order to prevent others from doing so.

Mr. Consul Wood's report from Bilbao deals with 310 mines working and 3,935 mines not working at present registered in that district. The Bilboa, Regato, Gueñes, Somorrostro, Galdames, Sopuerta Arcentales deposits are the most notable. Proprietors of working mines are exceedingly wealthy, and would be unlikely to part with these at prices which could be considered reasonable by would-be buyers. Owners of unworked mines would of course have less pretensions, but purchasers would be assuming some risks, as results could only be a matter of speculation. There are four kinds of ores worked in Viscaya, and these are "Vena," or purple hæmatite, "Campanil," red hæmatite, "Rubio," or limonite, and "Carbanoto," or siderite. "Vena" is of two qualities, hard and soft. It is the purest ore in Biscay, and was the only one used or worked at a time when its production was limited to the demand of the primitive and ancient forges of the country. There is no difficulty in the way of working, for the Spanish Government recognises the right of property held by foreigners, and willingly facilitates enterprise when legal regulations and stipulations are accepted and complied with. Foreigners are on a complete equality with natives in taking out claims for mines. The latest opinion asserts the existence of 50,000,000 tons of available iron ore in the actual mining district of Bilbao.

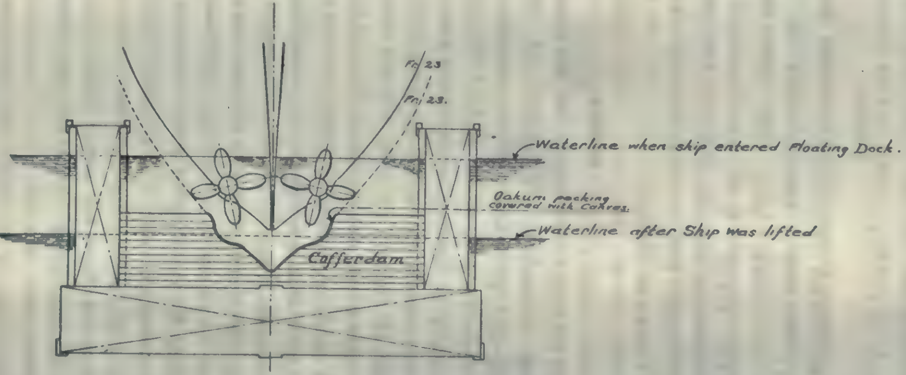
(*To be continued.*)


SHAWMUT
Fr 23
After Peak (Emptied at Yard)
Water line of Ship on arrival at Ship Yard
Water line of Ship when entering Dock
Deep Tank Empty
Tank No 6
Empty
Tank No 5
Empty
C.B.
Water line of ship when entering floating Dock
For Athwartship trimming of Ship.
Water line of Ship on arrival at Ship Yard
Fore Peak (Filled at Yard)
Cofferdam

PROFILE SHOWING SHIP ENTERING FLOATING DOCK



PROFILE SHOWING STERN OF SHIP LIFTED BY FLOATING DOCK.


Fr 23
Fr 23.
Waterline when ship entered Floating Dock.
Oakum packing covered with Canvas.
Waterline after Ship was lifted
Cofferdam

TRANSVERSE SECTION AT COFFERDAM
SHOWING STERN OF SHIP ENTERING FLOATING DOCK.

S.S. "SHAWMUT"—ARRANGEMENT OF FLOATING DOCK AND COFFERDAM FOR REPAIRING STERN.

DESCRIPTION OF REPAIRS TO S.S. "SHAWMUT."

By Naval Constructor T. F. Ruhm, U.S. Navy.

The *Shawmut* having broken her stern-post, a new forging was ordered from the East, and shipped to Seattle, where it was desired to remove the old stern-post and fit the new, and no dry-dock being available for the work the following mode of procedure was adopted :—

The Moran Bros. Company have a small floating dry dock capable of docking a vessel of about 3 000 tons, while the *Shawmut* is a large vessel belonging to the Boston Steamship Company of the following dimensions : length between perpendiculars, 488 ft. ; length over all, 505 ft. ; beam, moulded, 58 ft.; draft, loaded, 27 ft. 3½ in. ; displacement, loaded, 17,200 tons ; water bottom capacity, 2,100 tons.

It was decided to form a cofferdam around the stern and to utilise therefor the floating dry-dock.

The ship being light, the forward tanks were filled so as to bring her down by the head as shown on the accompanying sketch. This gave her a draft forward of 13 ft. 11 in., and aft of 13 ft. 3 in.

Across the floor of the floating dock, and at such a distance from the end that the upper corners of the sides of the dock would clear the ship's side, the ship's extreme beam being in excess of the width of the dock, was located a bulkhead, so inclined that when the dock was in its final inclined position this bulkhead would be practically vertical. The shape of the bulkhead was determined from the plan of the lines of the ship, the shape being taken at the section on which the bulkhead would rest.

The ship was hauled in place, her stern projection into the sunken dock and the dock was pumped out, thus lifting until the bulkhead came in contact with the ship's bottom and sides, after which the dock lifted at one end only.

As the dock lifted against the ship, the keel blocks shown on the sketch came into play, the stern of the ship thus being lifted, which was continued until the proper position of the dock was reached ; this position being such that the inclined floor of the dock and the bulkhead across the dock formed a triangular-shaped space with sides projecting above the water line sufficiently to insure safety in fairly rough weather.

After the dock had reached the desired position the water on the floor of the dock, held in place by the inclination of the floor and the bulkhead at the end, was partly drained through the floor of the dock into the tanks below, and the remainder pumped by improvised steam pump connections.

When this space was emptied of water, the stern was thus supported by the keel blocks and left projecting into the improvised cofferdam, and the work of fitting the stern-post was proceeded with, satisfactorily concluded, and the floating dock removed *

NOVEL ELECTRICAL SCHEME.

In connection with the Lewis and Clark Centennial Exhibition at Portland, Or., referred to recently, Mr. James R. Thompson, the electrical engineer of the Exposition, has conceived a number of entirely new features, chief among which is the submarine illumination of Guild's Lake. At intervals of 3 ft., 50-candle-power lamps in marine receptacles, have been placed on the bottom of the lake, which is about 6 ft. deep. The Government fish hatcheries have stocked the lake with black bass, golden carp and salmon trout, which may be seen swimming about among the water plants, the effect being at once unique and pleasing.

In the Mines and Metallurgy building there are exhibits of Oregon gold ore, and we are informed that since 1861, when a party of emigrants left a blue bucket to mark a place in eastern Oregon where they found a soft yellow metal, there has been $200,000,000 worth of gold taken from Oregon mines.

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* Read before the United States Naval Institute.

OPENINGS FOR TRADE ABROAD.

France—Algeria.

The expenditure of £708,000 has been authorised for the enlargement of the port of Oran.

East Africa.

The Manufacturers' Association of Great Britain call attention to openings in East Africa for agricultural implements and machinery.

Russia.

The construction of a railway between Taschkent and Omsk has been definitely decided on, and the Minister of Ways and Communications has already allotted about £126,000 for the purpose.

Natal.

Sir William Arbuckle, Agent-General for Natal, intimates that the time for lodging tenders with him or with the chairman of the tender board at Maritzburg for the Stuartstown Railway has been further extended until noon on Thursday, August 31st next.

Egypt.

The commercial intelligence branch of the Board of Trade have received a communication from the Administration of the Egyptian State Railways notifying that tenders for the supply of 210,000 metric tons of Welsh coal during the year 1906 will be received until October 1st. Specifications containing forms of tender can be obtained of Lieut.-Colonel Western, R.E., C.M.G., Queen Anne's Chambers, Westminster, S.W.

Netherlands.

An establishment for the testing of agricultural machinery has been started by the Government at the Agricultural College of Wageningen. Manufacturers' agents will be able to submit their machinery for testing and to request that their models may be brought to the notice of agriculturists. Manufacturers who are represented in the Netherlands will therefore be able to make their machinery and implements known through the medium of this institution.

British India.

The Committee of the Bengal Chamber of Commerce have addressed a communication to the Indian Railway Board on the subject of the inadequate supply of wagons on the East Indian Railway. The Committee understand that about 2,200 additional coal wagons have been asked for by the Railway Administration. Even if these are on the line by the end of the year, they are of opinion there will be no margin for expansion, and suggest the provision of at least 3,000 additional wagons before the beginning of next year.

Spain.

The British Vice-Consul at Huelva reports that it is understood the long projected railway from Huelva to Ayamonte, on the Portuguese frontier, is being taken in hand by the Madrid-Zaragoza-Alicante Railway Company and there is, therefore, every prospect of its becoming, at a not far distant date, an accomplished fact.

Algoa Bay.

The report of the commission of British engineers recommends either of the following: (*a*) a solid breakwater on the sea face 6,850 ft. in length, an inner quay 400 ft. by 300 ft., the widening of the inner portion of the Dom Pedro jetty, and the extension of the north pier to 7,650 ft., to be constructed at a cost of £1,100,000; (*b*) a south breakwater 7,000 ft. in length, connected with the shore by a viaduct approach of 1,000 ft., and having reclamation at its inner end, the extension of the north pier to 7,500 ft. in length, and of a new jetty of the mean length of 2,100 ft. and a width of 500 ft. This is estimated to cost £3,220,000.

Mexico.

H.M. Consul at Mexico City, in a recent dispatch, reports an opening in the State of Jalisco for all classes of electrical appliances and agricultural machinery. The tax on commercial travellers, he says, has recently been removed. The Consul also forwards a list of the principal merchants and manufacturers of Guadalajara, the Capital of the State of Jalisco. This list, which includes the names of firms dealing in electrical appliances and machinery and many other classes of goods, may be consulted by British manufacturers or exporters interested on application at the offices of the Commercial Intelligence Branch of the Board of Trade.

Germany.

A dispatch has been received at the Foreign Office from the Commercial Attaché to H.M. Embassy at Berlin enclosing a copy of a new law under which considerable extensions of the Prussian railway system are about to take place. Certain sums are also granted for the construction of light railways, a subject which receives great attention in Germany. A total sum of £7,446,950 will be expended, of which £7,196,950 are for broad gauge lines and rolling stock, and £250,000 are for new light railways. For the main lines £1,733,100 are allowed. A sum of £3,862,600 falls to nineteen branch lines, and £822,500 will be expended on a connection between the Cologne-Bonn and the Cologne-Troisdorf lines, including the bridging of the Rhine. The new rolling stock will cost £778,750.

NAVAL NOTES.

THE Parliamentary debate on the second reading of the Naval Works Bill was particularly interesting by reason of the light which was thrown upon the Admiralty's intentions regarding the proposed naval base at Rosyth. Mr. Lee explained that the broad result of the Admiralty's deliberations had been to push on the large expenditure foreshadowed at Rosyth, and not to proceed with the Chatham Dockyard extension. This, he said, would perhaps surprise some members in view of the scheme outlined in 1903 for an expenditure of £4,500,000 on the Chatham extension, but they had considered that that expenditure could be dispensed with, at any rate for the present, and this, he hoped, would be regarded as a great relief to the taxpayer. This decision was not the result of a mere change of mind ; it was the result of a change of circumstances and conditions. The original need for the Chatham extension was based on the report of the Berthing and Docking Committee, which showed that the then existing accommodation for the fleets was insufficient, and that its extension was imperatively necessary. That position was altered as one of the results of the new policy of casting ineffective ships from the Navy. These ships required considerable berthing and docking facilities because of the constant and ever-increasing repairs which they needed, and their removal from the effective list had set free so much berthing and docking accommodation as to render unnecessary the proposed extension at Chatham. It was probable that in future warships would be fewer in numbers, but of greater individual power, and consequently less berthing and docking space would be required, but that space must be suitable for the accommodation of the largest ships. There was a shortage of such accommodation on the East coast, therefore it was necessary to provide it either at Rosyth or at Chatham, but not at both.

The Admiralty had decided on the unanimous recommendation of its naval advisers that Rosyth possessed greater strategical, economic, and industrial advantages than Chatham. Plans were ordered to be prepared on the most comprehensive scale for a first-class naval port at Rosyth. Hitherto dockyards had been laid out on too cramped a scale, so that it was extremely difficult and costly to extend them afterwards. It was, therefore, determined that Rosyth should be so laid out, and the works so constructed as not to prejudice any extension of the base that might become necessary in the future. The plans that had been prepared were for a dockyard of the most complete description, but it was not the intention of the Admiralty at once to construct the dockyard on so large a scale. Only the immediate needs of the Admiralty were to be considered. Still the works that were proposed in the present scheme would, in themselves, form a first-class naval base. They included a closed basin of the largest size, with an entrance lock which could be used as a dock itself in case of necessity ; a large graving dock ; the necessary equipments of a repairing yard ; railway connection with most of the railway systems of the country ; and a considerable amount of foreshore dredging and reclamation in order to make the place accessible at all stages of the tide. The total cost was £2,500,000, which included the £200,000 that had already been voted for the works. The £70,000 in the Bill for Chatham was in the process of expenditure on the new river wall to the Medway, which was necessary because the existing wall showed signs of falling in.

In the course of his speech, Mr. Lee remarked that the retiring Civil Engineer-in-Chief, Sir Henry Pilkington, K.C.B., deserved the greatest credit for the unbroken success of his designs and operations during the time he had presided over these works. He had carried out some of the largest engineering works of any period of the world's history without a single failure of any sort or description.

Lord Charles Beresford adequately sums up the claims of the Naval Pocket Book when he says that it is invaluable to all who take an interest in naval matters. The new edition* which is before us, shows the usual painstaking which we are accustomed to associate with the editorship of Sir W. Laird Clowes, although we regret to learn that owing to ill-health he has been prevented from completing the edition single-handed. Mr. Rollo Clowes has superintended the revision of a large part of the work, and acknowledgment is made of the assistance by Mr. E. G. P. Wyatt; Lieut. B. Machado, of the Brazilian navy; Mr. De Voogt, of Amsterdam; Mr. Alan H. Burgoyne, who has contributed useful notes; Mr. J. W. Reed; Commander Bultinck, of the Belgian Marine, for facts concerning the Congo flotilla; Rev. A. S. Bishop, and many others. It is significant that submarines, which last year were the subject of a special and separate section, are this year dealt with like other war vessels, each country's flotilla being described in the place to which it seems more appropriately to belong.

Comparative tables, showing respectively the material strength of most of the Powers, and the amount of recent naval expenditure on the part of the more important of them, have been added. The list of errata and occurrences during printing includes a brief summary of losses at the battle of Tsushima. In view of the references which are constantly being made to one or other of Admiral Rojdestvensky's unfortunate ships it is perhaps just as well that the general section is allowed to remain, but of course the wiping out of the Russian navy necessarily plays havoc with comparative tables.

For the benefit of any of our readers who are not familiar with the Naval Pocket Book we append the following outline of contents: The Navies of the World—A complete list, with details of displacement, armament, protection, engines, coal, capacity etc.; Notes on Torpedoes; The Comparative Naval Expenditure of the Powers; the Comparative Fighting Strength of the Powers; List of Dry Docks; Personnel of Leading Navies; Plans of Ships; Table for Conversion of Measures; Trial Trip Tables; Steam Trials of British and Foreign Ships; and Complete Index of Ships by name.

It is satisfactory to know that everything possible is being done to afford a thoroughly hearty welcome to the officers and men of the French squadron who will be entertained at the Guildhall on Thursday and Friday next. The officers will number 190, and will be received by the Lord Mayor and the sheriffs in the Guildhall library. The seamen, on their arrival on the following day, will drive along the Thames Embankment, reaching the Guildhall by way of Queen Victoria Street, Queen Street, and King Street. The company will number at the Guildhall on that day not more than 300. An entertainment at the Alhambra will follow the luncheon, the profits being devoted to the French Hospital in London.

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* Published by Thacker and Co. 7s. 6d. net.

THE IRON AND STEEL INSTITUTE.

PROGRAMME OF THE SHEFFIELD MEETING.

THE Autumn Meeting of the Iron and Steel Institute will be held at Sheffield on Tuesday, Wednesday, Thursday, and Friday, the 26th, 27th, 28th, and 29th of September next. Papers have been offered for reading on the following subjects :—

The Metallurgical Department of Sheffield University. By Professor J. O. Arnold (Sheffield).

The Thermal Transformation of Carbon Steels. By Professor J. O. Arnold and A. McWilliam (Sheffield).

The Nature of Troostite. By Dr. Carl Benediks (Upsala).

The Occurrence of Copper, Cobalt, and Nickel in American Pig Irons. By Professor E. D. Campbell (Ann Arbor, Michigan).

Pipe in Steel Ingots. By J. E. Fletcher (Sheffield).

Steel for Motor-Car Construction. By L. Guillet (Paris).

The Presence of Greenish-Coloured Markings in the Fractured Surface of Test Pieces. By Captain H. G. Howorth, R.A. (Sheffield).

Over-Heated Steel. By Arthur W. Richards (Grangetown) and J. E. Stead, F.R.S. (Member of Council).

Segregation in Steel Ingots. By B. Talbot (Middlesbrough).

A Manipulator for Steel Bars. By Douglas Upton (Jarrow).

Machinery for Breaking Pig Iron. By Cecil Walton (Whitehaven).

The Influence of Carbon on Nickel and Iron. By George B. Waterhouse (New York).

The following outline programme has been issued :—

Monday, 25th September.

The Hon. Secretaries' Office will be open in the Cutlers' Hall, Sheffield, from 2 p.m. to 6 p.m., for the registration of addresses, issue of badges of membership, programmes, invitation cards, etc.

Tuesday, 26th September.

9.0 a.m.—The office of the hon. secretaries (Mr. J. Rossiter Hoyle, Vice-Chairman, Professor J. O. Arnold, Mr. A. McWilliam, and Mr. John Wortley) will be open at the Cutlers' Hall, and daily during the meeting.

10.0 a.m.—Reception of the President, Council and Members of the Institute in the Firth Hall of the Sheffield University, by the Hight Hon. the Lord Mayor (Sir Joseph Jonas, J.P.) ; the Vice-Chancellor of the Sheffield University (Sir Charles Eliot, K.C.M.G., C.B.) ; the Master Cutler (Mr. George Hall) ; Col. H. Hughes, C.M.G., Chairman, and the Members of the Reception Committee. Reading and Discussion of Papers.

1.0 p.m.—Adjournment to the Cutlers' Hall for luncheon, at the invitation of the Reception Committee.

Visit A.—After luncheon members may visit the University Metallurgical Department to inspect the laboratories. By the kind permission of the City Council, Weston Park and the Museum and Mappin Art Gallery will be reserved for members of the Iron and Steel Institute and their friends during the hours of 2.30 p.m. to 5.30 p.m. Selections of music will be rendered and tea will be provided by the Reception Committee. Alternative Visit B.—To the Works of the Sheepbridge Iron and Coal Company, Ltd., near Chesterfield. Visit C.—To the Britannia Works of Messrs. J. Hopkinson and Co., Ltd, Huddersfield, Valve and Steam Fittings. The alternative visits specified below will also be available each day.

9.0 p.m.—Reception by the Right Hon. the Lord Mayor and the Lady Mayoress at the Town Hall.

Wednesday, September 27th.

10.0 a.m.—Reading and Discussion of Papers at the University.

1.0 p.m.—Visit A.—To the East Hecla Works of Messrs. Hadfield's Steel Foundry Co., Ltd. Visit B.—To the Iron and Wire Rope Works of Messrs. W. Cooke and Co., Ltd, Tinsley.

8.0 p.m.—The Members of the Institute are invited to dinner at the Cutlers' Hall by the Reception Committee. The ladies and members wishing to accompany them are invited to dinner at the Royal Victoria Hotel, at 6.30 p.m., and to the performance at the Lyceum Theatre, where the Reception Committee have engaged seats for them. A new musical play will be produced.

Thursday, September 28th.

10.30 a.m.—Visit A.—Members are invited to the Norfolk Works of Messrs. Thos. Firth and Sons, and to the Atlas Works of Messrs. John Brown and Co., Ltd. Visit B.—To the Works of the Parkgate Iron and Steel Company, Ltd., near Rotherham. Visit C.—To the Grimesthorpe Works of Messrs. Cammell, Laird and Co., Ltd.

2.0 p.m.—Visit D.—To the River Don Works of Messrs. Vickers, Sons and Maxim Ltd. Visit E.—To the Ickles Works of Messrs. Steel, Peech and Tozer, Ltd.

9.0 p.m.—Dance and Reception at the Cutlers' Hall by invitation of the President and Mrs. R. A Hadfield, Friday, September 29th.

EXCURSION A.—TO WELBECK AND THE DUKERIES.

10.0 a.m.—Members and ladies accompanying them will leave the Great Central Railway Station by special train, provided by the Reception Committee, for Worksop; thence by conveyances to Welbeck Abbey, *via* the Sparken Hill entrance. 1.0 p.m.—Luncheon will be served in the Riding School, after which the drive will be continued to Edwinstowe Clumber, *via* Thoresby, etc. 4.45 p.m.—Tea will be provided at Clumber.

EXCURSION B. TO CHATSWORTH, ROWSLEY, AND HADDON HALL.

9.30 a.m.—Members and ladies accompanying them will leave the Cutlers' Hall in conveyances for Chatsworth Park. 2.0 p.m.—Luncheon will be provided at Chatsworth. After lunch the drive will be continued to Rowsley and Haddon. Tea will be provided at Haddon Hall. 6.0 p.m.—The return journey will be commenced.

9.0 p.m.—There will be a display of fireworks, and musical selections will be given by a band at Wincobank Ridge.

Alternative visits have been arranged to the works of the following on specified days: Messrs. J. Beardshaw and Sons, Ltd.; Messrs. John Bedford and Sons, Ltd.; Messrs. James Dixon and Sons, Ltd.; Messrs. Dalton Main Collieries, Ltd., Simon Carves Plant; Messrs. D. Doncaster and Sons.; Messrs. G and J. Hall; Messrs. Harrison, Bros. and Howson; Messrs. H. E. Hoole and Co.; Messrs. J. Hopkinson and Co.; Ltd.; M. Hunter and Son, Ltd.; Messrs. Wm. Hutton and Sons, Ltd.; Messrs. Mappin and Webb, Ltd.; Messrs. Nunnery Colliery Company, Ltd.; Messrs. S. Osborn and Co; Messrs. Joseph Rodgers and Sons, Ltd. Messrs. J. J. Saville and Co Ltd.; Messrs. Seebohm and Dieckstahl, Ltd.; Messrs. Sheffield Corporation Electric Supply Department; the Engineering Department of the University; Messrs. Thomas Turner and Co.; Messrs. Walker and Hall.

The following firms, while not making any special arrangements, will be pleased to receive any of the visitors desiring to see their works: Messrs. The Brightside Foundry and Engineering Company, Ltd.; Messrs. Brown Bayley's Steel Works, Ltd.; Messrs. Howell and Co., Ltd., Wincobank; Messrs. J. Grayson, Lowood and Co., Ltd., Deepcar; Messrs. George Senior and Sons, Ltd.; Messrs. Staveley Coal and Iron Co., Ltd., near Chesterfield; Messrs. Tinsley Park Colliery Company, Ltd.; Messrs. Thos. W. Ward, Ltd.

By the courtesy of the Great Western, the Midland, the Caledonian, the London and North Western, the Great Northern, the Lancashire and Yorkshire, the Great Central and other railway companies, return tickets to Sheffield at a single fare and a quarter, available from September 23rd to September 30th, will be issued from London and provincial towns on production of a voucher signed by the secretary, Mr Bennett H. Brough.

THE BRITISH ASSOCIATION.

ABOUT one hundred and fifty members of the British Association left Southampton in the Union-Castle mail steamer *Saxon* for Cape Town last Saturday afternoon. They included Professor G. H. Darwin, president-elect, Sir William Crookes, Sir Benjamin Baker, Sir Augustine Baker, Sir Lauder Brunton, Rear-Admiral Sir William Wharton, Major P. A. MacMahon, Dr. David Wilson, Dr. A. A. Rambaut, Mr. Alexander Siemens, Professors Herdman, J. O. Arnold, C. Bohr, Vernon Boys, Ernest Brown, D. H. Campbell, H. S. Carhart, Cordier, W. M. Davis, H. B. Dixon, A. R. Forsyth, W. M. Hicks, W. H. H. Hudson, C. J. Joly, J. Milne, J. Perry, J. Bonsall Porter, W. B. Scott, J. Y. Simpson, H. Sjögren, W. J. Sollas, H. Thompson, Woodhead, Sydney Young, Principal J. D. McCulloch, Sir Richard Jebb, M.P., Colonel D. A. Johnson, C.B., Dr. Tempest Anderson, Mr. William Briggs, LL.D., Dr. Alex. Findlay, Dr. M. O. Forster, Dr. A. C. Haddon, Dr. Halliburton, and others. The Mayor of Southampton (Colonel E. Bauer, D.L.), Mr. Sheriff Cawte, Colonel Swalm, the American Consul, were present on board, and the Mayor wished the members of the Association a pleasant voyage and successful meetings. Professor Darwin, in reply, said that the meetings of the Association in South Africa had really an imperial significance, for they were desirous of pushing forward literary, scientific, and educational interest in South Africa as well as elsewhere.

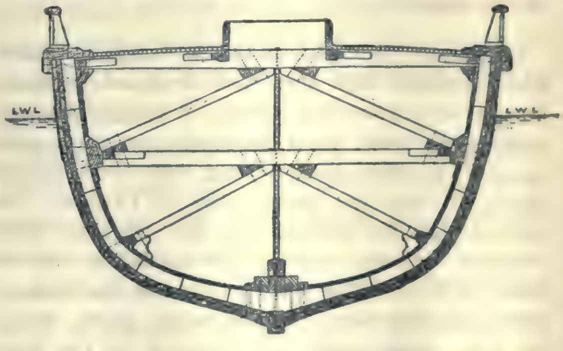
SHIPBUILDING NOTES.

THE new Arctic ship *Roosevelt*, which has been built by the Peary Arctic Club to enable Commander Peary to make another attempt to reach the North Pole, is 160 ft. long on the load waterline; 184 ft. in length over all; with a beam at the waterline of 32 ft., and over the guard-strake of 35 ft. 6 in. She has a depth of 16 ft. 6 in. and at full load has a displacement of about 1,500 tons. The form of the ship and its construction have been designed to meet the severe conditions of the service for which she is built. Her cross section and her diagonals show a model that is very round below the waterline, and indeed from the guard-strake her sections narrow down to a broad easy bilge, to which there is a very sharp dead rise from the keel. This form is chosen to enable the ship to rise when she is being nipped by the ice, pressure upon her wedge-shaped hull tending to lift her bodily upward. In addition to her heavy frames and triple planking and sheething, she is strutted and trussed from end to end with massive horizontal and diagonal timbers. The stem, sternpost, keel, keelsons, frames, plank-sheer, and garboard-strake are all of selected white oak, all bolted and drift-bolted with more than usual thoroughness. The frames are moulded to 16 in. at the keel and 10 in. at the head, and they are placed only 2 ft. apart from centre to centre. To give longitudinal strength, a lattice-work of diagonal straps of steel is laid for the full length of the ship, the distance from strap to strap being about 6 ft. The straps are rabbeted down flush into the outside face of the frames.

The skin of the ship consists of two courses of 5 in. planking, the inner course of yellow pine and the outer of white oak. Between the two courses is laid a sheathing of tarred canvas. On the inside the frames are covered with 3 in. white oak ceiling, and it can be seen at once that these four layers of planking and waterproof material will render the ship not only water-tight and stiff, but warm in cold weather. The beams of the main deck are spaced 4 ft. apart, centre to centre, and the lower beams are immediately below the deck beams. A system of diagonal struts is worked in between the beams, the whole being thoroughly tied with through bolts. The system of trussing is completed by a central line of tie-rod stanchions, the tie-rods running down inside the wrought-iron piping. These stanchions are constructed so that they can be tightened up at any time like the truss rods of the old wooden Howe truss bridges that did such good service on grinding early railroads.

The *Roosevelt* is protected against the grinding of passing ice by special protection at the bow, stern, and waterline. The motive power consists of a single inverted compound engine, driving a 10 ft. four-bladed propeller. Steam is supplied by two water-tube boilers, and, under trial, the *Roosevelt* made about 12 knots. For the above details, as well as for the accompanying cross-section, we are indebted to the Scientific American.

The new steel screw-steamer *Eslington*, built by Messrs. Wood, Skinner and Co., Ltd., Bill Quay-on-Tyne, to the order of Messrs. Arnott, Miller and Co., of Newcastle-on-Tyne, left the Tyne for her official trial trip on Wednesday. The vessel is of the raised quarter-deck type, with sunk poop, bridge, and topgallant forecastle. Water ballast is provided in the cellular double bottom all fore and aft, and also in the fore and after peaks. The vessel is rigged as a two-masted schooner, and is fitted with every improvement and appliance for facilitating the rapid loading and discharging of cargo and general working and navigation. The propelling machinery, which has been constructed at the Northumberland Engine Works of the North-Eastern Marine Engineering Company, Ltd., Wallsend-on-Tyne, consists of a set of their latest type of triple-expansion engines, having cylinders 16 in., 26 in., and 43 in., with 33 in. stroke, steam being supplied by a large steel boiler. Both the ship and engines have been constructed to the requirements and under the special survey of Lloyd's for their highest classification. On the measured mile off Whitley the engines worked without



CROSS SECTION OF THE "ROOSEVELT."

the slightest hitch, and gave great satisfaction to all present, amongst whom were Mr. H. Arnott, of Messrs. Arnott, Miller and Co., Mr. W. G. Reynolds, under whose supervision both hull and machinery have been constructed, Mr. Skinner representing the shipbuilders and Mr. J. Daglish representing the engine-builders.

The new steel screw steamer *Fook Sang*, built by Messrs. W. Dobson and Co, of Low Walker on Tyne, to the order of Messrs. The Indo-China Steam Navigation Company, Ltd., of London, left the Tyne for her official trial trip on Wednesday last. This vessel which has been built to the highest class at Lloyd's and to the Board of Trade requirements for passenger certificate, is of the following dimensions: length (between perpendiculars), 330 ft. 6 in.; breadth 44 ft.; depth (moulded to spar-deck), 26 ft. 6 in.; and is specially fitted for the requirements of the owners' trade between Hong Kong and Java. The upper decks are sheathed with teak, and the 'tween deck is arranged for carrying coolies. The propelling machinery, which has been constructed at the Northumberland Engine Works of The North-Eastern Marine Engineering Company, Ltd., Wallsend-on-Tyne, consists of a set of their latest type of triple-expansion engines, having cylinders 23½ in., 39 in., 66 in., by 45 in. stroke, steam being supplied by two large steel boilers working at a high pressure, and fitted with Howden's forced draught arrangements.

On the trial run the machinery worked without the slightest hitch, and gave satisfaction to all concerned, a mean speed of about 12 knots being attained. A large number of visitors were present on the run, including Mr. Wells, representing the owners, Mr. T. P. Murdoch, owners' superintendent, under whose supervision both hull and machinery have been constructed, Messrs. H. and W. Dobson representing the shipbuilders, and Mr. D. Myles representing the engine builders. After the trial the vessel proceeded on her voyage.

On Monday, July 31st, Messrs. R. Craggs and Sons, Ltd., launched from their Tees dockyard, Middlesbrough, a fine steel cargo steamer of the strengthened type. This vessel, whose dimensions are 364 ft. 3 in. by 47 ft. by 26 ft. ½ in., is being built under special survey to take the highest class at Lloyd's. The arrangements for handling ship and cargo are most complete in every respect. The machinery will be fitted by Messrs. Blair and Co., Ltd., of Stockton-on-Tees, and will have cylinders 24 in., 40 in., 66 in., by 45 in. stroke, steam being supplied by two large single-ended boilers working at 180lb. pressure to the square inch. The vessel has been built to the order of Messrs. Henry Fernie and Son, of Liverpool, and on leaving the ways was named *Ramazan* by Miss Fernie. The specifications have been supervised, and the construction of the hull and machinery have been superintended by Captain King and Mr. H. F. Payne respectively.

On the 31st ultimo the steel screw steamer *Kara Sea*, built by Messrs. Craig, Taylor and Co., Ltd., Stockton-on-Tees, to the order of Messrs. Sanders, Wake and Co. London, was taken to sea for her trial trip, which proved highly satisfactory. The engines, which have been constructed by the North-Eastern Marine Engineeering, Company, Ltd., Sunderland, have cylinders 21 in., 35 in., 57 in., by 39 in., with two large steel boilers working at 180 lb. pressure. A speed of 11 knots was maintained on the run from Hartlepool to Souter Point. This vessel is a duplicate of the *White Sea*, which Messrs. Craig, Taylor and Co., Ltd., built for the same owners last year.

On Tuesday, August 1st, Messrs. William Gray and Co., Ltd., launched the handsome steel screw steamer *Domira* for Messrs. Maclay and McIntyre. She will take the highest class in Lloyd's, and is of the following dimensions, viz., length over all, 342 ft.; breadth, 47 ft. 6 in.; and depth, 24 ft. 9 in., with long bridge, poop and topgallant forecastle. Triple expansion engines are being supplied by the Central Marine Engine Works of the builders, having cylinders 24 in., 38 in., and 64 in. diameter, with a piston stroke of 42 in., and two large steel boilers for a working pressure of 180 lb. per square inch. The ceremony of naming the steamer *Domira* was performed by Miss Harriett Wood, of West Hartlepool.

On Saturday last the s.s. *Serbury*, a large single-deck turret steamer, was launched from the yard of Messrs. William Doxford and Sons, Ltd., Pallion. Unlike the preceding launch from this yard a week ago—when, owing to a subsidence of the ground near the river a large turret steamer took no less than six days to launch—the *Serbury* was afloat within half-a-minute from her release from the blocks, and proceeded at once to her outfitting berth. She is built to the order of Messrs. George Horsley and Son, West Hartlepool, and is the eighth turret steamer built for this firm. She was named the *Serbury* by Mrs. Briggs-Bury, of Manchester, who was accompanied by a number of friends.

PROSPECTING WORK AT ERIDIA, EGYPT.

By Ronald Sawyer.

ERIDIA is situated about fifty miles west of Keneh, a large native town on the Nile, some four hundred miles south of Cairo, and was chosen as a mining site by Mr. C. J. Alford in his 1895 expedition.

A supply of water is obtained from an old well which was reopened by the company last year; this supply could be supplemented if required from several rock pools near by; there is every reason to believe that this was the well used by the ancient Egyptian miners.

GEOLOGY.

The vein lies in what may be termed an island of "green" rocks in a sea of "red" granite; the "green" rocks consist of an igneous mass of gray granite intersected in all directions by dykes of greenstone. In places the doleritic greenstones so largely predominate that the granite can hardly be observed. In association with these veins or dykes there occur veins and coatings of green epidotes, and where there is much of this mineral the surrounding rock is much decomposed, and seems to show signs of solfactáric action. The red granite consists almost entirely of quartz and pink felspar, while the grey granite is of the hornblende biotite variety. The greenstone is believed to be olivine dolerite.

The junction of the pink and grey granite is generally a line of softness, and consequently is often hidden by being at the bottom of a wady, but occasionally a perfectly sharp junction may be seen. In other places great metamorphism is observable, and it is hard to say where one ends and the other begins.

In the grey granite there are also dykes of dark red quartz felsite; these are not nearly so common as the doleritic dykes, but they are generally of great length and persistence. In the pink granite there are a large variety of dykes, the commonest being the quartz felsite or porphyry, less commonly the dolerite, and occasionally some very beautiful porphyritic rocks. These dykes are nearly all harder than the surrounding rocks, and so stand up as great ridges and walls.

As regards the relative age of these rocks, a place was observed near Eridia, where the evidence semed especially clear; at the junction of the pink and grey granite, a quartz vein running in the latter was completely cut off by the former; further along the junction is a lens-shaped mass of quartz felsite separating the red and grey granite, and having apparently come up between them. The dark greenstones seem to cut through everything, but occasionally they are cut by the quartz porphyry.

This, then, gives the order as follows, beginning with the newest: (1) Dark doleritic greenstone; (2) Quartz felsites and porphyries. (3) Red granite. (4) Dark hornblende biotite granite.

It is only in the latter that the quartz veins carry gold, those in red granite being invariably barren.

The main veins run for close on a mile nearly due north and south, and over the entire length have been worked by the ancients, some of the upper slopes being still open for a depth of 30 ft. to 40 ft., but the lower ones are filled in with rubbish.

The dip averages 80 deg., and the quartz has been taken out to a width of over 4 ft. in some places, the walls being left perfectly clean and smooth.

At the north end the vein lies between firm walls of granite, but at the southern end one wall is often of intrusive greenstone and the sides show considerable signs of motion and crushing.

The quartz varies from being fresh, unaltered and hard, to broken and decomposed; the richest quartz was found to be stained a dark red heather colour along the cracks, due to an oxide of iron. At the extreme south end of the vein this hæmatite forms a considerable layer on one side of the quartz, which is much decomposed, the rock on each side being full of pyrites.

METHOD OF WORKING.

Practically all the quartz has been removed from the vein to a considerable depth, below the surface, so that although the rich chutes could not be found by assaying, it was very evident, from the amount of stuff thrown out, which were the rich places and which barren.

Therefore two shafts were sunk, one vertical in the rock, one along the vein through the old workings, and cross-cuts were started to cut the vein at two points between the shafts, The vertical shaft has so far proved the quicker and cheaper, as the other shaft in the old workings has been considerably delayed by the rotten nature of the ground, and had to be lined with masonry for the first 60 ft. In the inclined shaft two sets of rails were put in and self-tipping trucks used.

The workmen are chiefly fellaheen, but a fair number are Bedouins of the following tribes: from the north, Maaze and Soubahi; from the south, Ababdeh and Bishareen. They are generally paid by piecework, at the rate of one piastre for 6 in. drilled, the average earning for a good driller being eight piastres—1s. 8d. per day.

Rates of pay:—

	Per Day. Piastres.	Per Day. English.
Forge boy	4	10d.
Unskilled labourer	6	1s. 2½d.
Skilled ,,	8	1s. 8d.
Carpenter	12	2s. 2d.
Overseer and blacksmith	15	3s. 0d.

THE NATIVE MINERS.

The natives are, as a rule, very willing and quick to learn, and soon become excellent miners. The Bedouins are particularly fearless, and may always be relied upon at a pinch.

Occasionally, contracts were given at rates varying from 15s. to £1 per foot, driven 6 ft. by 4 ft. in the granite with dynamite supplied free, and measurements were taken once a week, but the former methods was found more satisfactory, although involving extra work in measuring up every day.

The rate of advance in the cross-cuts varied from 2 ft. per week in the hardest dykes to 9 ft. per week in the granite. Three shifts of eight hours each were employed in most places, and the holes were blasted once a day, as a rule just about sunrise, this being the coolest time of the day, and the ventilation consequently best.

The temperature in a drive 20 ft. long at a depth of 60 ft. averaged 90 deg., and as the temperature of the air above ground was generally over 100 deg. during the summer, efficient ventilation became difficult. To anyone going underground the temperature seemed far higher than above-ground, owing to there being a slight percentage of moisture in the air underground.

In assaying, the following charge suits well:—

Ore	500 grs.
Red lead	250 ,,
Argol	60 ,,
Sodium carbonate	800 ,,

The gold always occurs free and is often visible. Where there is much galena and pyrites the value is generally low. A very good approximation to the value of a sample could always be obtained by panning a 5 lb. sample of the ore crushed to 20 sieve and judging from the length of the tail.

From the Bulletin of the Institution of Mining and Metallurgy.

JUNIOR INSTITUTION OF ENGINEERS.

A VISIT to the new Vauxhall Bridge works was made by the members of this institution on the evening of the 25th ult.

The Vauxhall new bridge at present in course of construction is to replace the old bridge opened in the year 1816, which was the first iron bridge built across the Thames. It consisted of nine cast-iron arches, each of 78 ft. span, with stone piers and abutments. With the increase of traffic, the bridge being only 30 ft. 6 in. wide proved too narrow, and in 1895 the London County Council obtained an Act for its rebuilding. The new structure, when finished, will have five steel arches, built upon granite masonry forming the piers and abutments. The centre span will be 149 ft. wide in the clear, the two intermediate spans 140 ft. 4 in., and the shore spans 130 ft. 6 in. respectively. The method of construction, after the old bridge had been removed, was to build dams similar to the ones now visible at the Lambeth abutment of 14 in. by 14 in. tongued and grooved piles. Around these dams protective dolphins were placed for the security of the river traffic. Some of these dolphins are still in existence. The foundations of the piers are in clay. Considerable difficulty was experienced in the case of the Westminster abutment, and of the pier supporting the Westminster central arch on the Westminster side. In the latter case, when the excavations of the foundations were nearly completed, the dam burst, and very serious difficulty was met with in its repair. The work of the dams and construction of the abutments and piers to a height of 9·75 above O.D. was carried out by Messrs Pethick Bros. The work of building the upper portion of the masonry and the steel superstructure of the bridge is in the hands of Mr. Charles Wall. At the present moment the stonework of the four piers is completed, and nearly the whole of the granite work of the abutments. The granite used is Cornish, of the finest white quality. Of the steel superstructure about two-thirds are completed, 47 ribs out of 65 being in position and a fair proportion of the decking fixed. Particular attention has been given to the decorative features of the bridge. Above the level of the masonry of the piers the iron framing will be covered at each end by plate work extending from the level of the granite to the top of the parapet. In each plate end will be sunk a panel in which will be placed a bronze statute about 10 ft. in height. The parapet itself will be of special design, consisting as it does of an ordinary parapet about 3 ft. 6 in. high, above which is placed on ornamental balusters a moulded plinth.

CAPE GOVERNMENT RAILWAYS.

THE report of the General Manager of Railways for the six months ended June 30th, 1904, and dated from Cape Town, March, 1905, states that at the time of writing all the rolling stock ordered under the Loan Bill of 1902 had been received and placed in traffic with the exception of 50 steel bogies.

In connection with the workshop accommodation at Uitenhage, Mr. Thornton, locomotive superintendent of the Midland district, reports that the new saw mill is in course of erection, and several approach roads have been laid in. The erection of the new electric traverser between the erecting shops has been completed, and it is working very satisfactorily, and is a great improvement on the old steam one it replaced. The extension of the foundry shop is finished and when the pillars and cranes are erected considerable economy will be effected in the output of castings. One portion of the machine shop was extended and utilised as a new stationary engine boiler house, which has increased the accommodation for the electrical department. The north erecting shop has been extended towards Constitution Road, and the additional shop room thereby provided is being made use of by the boilermakers.

Mr. Beatty, the chief locomotive superintendent, in his report on the working of the locomotive department states that the 8th class twelve-wheel type locomotives in use upon the Western system have been concentrated upon the Tonws River—Beaufort West district—for the purpose of working the passenger, trains over the 1 in 40 gradients, without double heading up to eight-bogie vehicles. They are doing this work successfully, but the speed is too high for them, and it is to be expected that the cost of keeping these engines in repair will be heavy. At the same time it is a great source of economy avoiding the double heading. What is wanted is a locomotive with the hauling power of the 8th class, and capable of maintaining the required speed without undue wear and tear.

During the six months January to June, 1904, there were 32 engine failures on the Western system, 66 on the Midland system, and 17 on the Eastern system. Of these failures 58 were the result of boiler leakage. There has been a gratifying reduction in the number of such failures as compared with last year, more particularly on the Beaufort West—De Aar district. The improvement on the district is, no doubt, principally due to the use of the soft water from Stoltzhoek Dam, but the new type of wide firebox locomotive has also contributed to reduce the number of failures in a marked degree.

COMPANY REPORTS AND MEETINGS.

METROPOLITAN RAILWAY COMPANY.

SIR CHARLES McLAREN, in moving the adoption of the report, said that the management had had to face exceptional circumstances during the half-year arising out of the dual working by steam and electricity, a necessary process during the transition stage. Some alteration had been made in their classes, consequent upon bringing into traffic their new electrical cars which were of two classes only, and therefore between all stations from Baker Street to Harrow and Uxbridge, and from those stations to the "circle" they now issued only first and third-class tickets.

The company commenced on January 1st last to run some electric trains between Baker Street and Harrow, and between Harrow and Uxbridge. The number of these trains had been gradually increased until the whole of the service on the extension lines between Baker Street and Harrow and Uxbridge was now worked electrically, though they still had the trains from Baker Street to and from stations beyond Harrow, on the Aylesbury line, worked by steam. They had had some few failures and stoppages while bringing in the electrical service, but nothing of a serious character, and certainly nothing more than might be regarded as inevitable in the making of so radical a change. With reference to the working of the "circle" by agreement with the District Company, they made arrangements to commence to work all the trains on the "up" road electrically on the 1st inst., but, unfortunately, the service over the District Company's part of the "circle" line had to be discontinued in the course of a few hours, as certain difficulties became apparent in connection with the conductor rails and car equipments. The matter was still in negotiation with the District Company, with a view to deciding upon the necessary slight alterations to be made, and they hoped to be in a position very soon to resume continuous working round the "circle" with electric trains. In the meantime this company were running a service of electric trains between 7 a.m. and midnight in addition to the ordinary service of steam trains on their portion of the "circle"—namely, between South Kensington and Aldgate, via Paddington. With respect to their electric installation, Mr. Parker, their consulting electrical engineer, told him that subject to the tests which were now proceeding to enable him to give his certificates, he was satisfied that the machinery, when it was completed, would be sufficient in all respects for the amount of work required to be done. Their experience so far went to show that the speed of the trains and the energy per train ton mile had come up to expectations. Mr. Parker stated that there seemed to be little doubt that they would ultimately be able to produce their current at the low figure of ½d. per unit, and he was further of opinion that they would be able to show that the cost of the installation per kilowatt would compare favourably with any installation which had yet been put down.

PEASE AND PARTNERS, LTD.

The profit for the past year's working is stated at £77,231, and added to the balance brought with this is a sum now available for dividend and other purposes of £78,069. Of this sum £16,582 has been applied as interest on debentures and £21,788 to depreciation on leaseholds; and the directors recommend the payment of 10s. per share on the ordinary shares, carrying forward £4,698. The report adds that the first half of the financial year was characterised by inactive demand and very low prices. The second half brought in both respects marked improvement. The capital expenditure during the year has been limited to the opening out of the Windlestone coalfield and its more complete undergound connection with the Eldon coalfield; and to expenditure upon coke ovens. The important acquisition of the entire interest in Wilsons, Pease and Co. is stated to have fully justified itself.

CONSETT IRON COMPANY.

The report states that the profit for the past year amounted to £244,824. The directors recommend that £20,000 of this sum be taken to meet the interim dividend of 4s. per share on the preference shares, paid on February 15th last, and £37,500 to meet the 7s. 6d. per share on the ordinary shares. They also recommend the payment of 4s. per share on the preference shares and 30s. on the ordinary shares, and to carry forward £153,163. The directors add that the result of the year's work has been more satisfactory than might have been expected under the inactive state of trade which prevailed during the first half of the year.

CONTRACTORS' NEWS.

We shall be pleased to insert under his column, free of charge, particulars of open contracts.

CONTRACTS OPEN.

Last Day.

Ebbw Vale (Mon.).—The following for the Ebbw Vale Urban District Council: (Section A) cables; (B) overhead lines; (C) street lamps and fittings; (D) meters. Mr. Reginald P. Wilson, 66, Victoria Street, Westminster. ... ... Aug. 5

Swansea.—Supply of new slightly defective or good second-hand steel rails and fishplates, as follows, for the Swansea, Harbour Trustees: 100 to 200 tons rails, Vignoles flat-bottomed section, about 75lb. per yard, with fishplates to match, delivered f.o.r. Prince of Wales's Dock. Mr. Talfourd Strick, clerk, Harbour Offices, Swansea ... ... Aug. 10

Appleby (Lincs.). — Construction of a concrete and steel service reservoir in the parish of Appleby in the county of Lincoln for the Brumby and Frodingham Urban District Council. Mr. Alfred Atkinson, C.E., Brigg ... ... Aug. 14

Carlisle.—Construction of a storage reservoir, etc., to contain about 180 million gallons, on the Castle Carrock Beck, about nine miles from Carlisle, for the Carlisle Corporation. Messrs. James Mansergh and Sons, 5, Victoria Street, Westminsfer ... ... Aug. 14

Maryport.—Tender for a new centre-ladder, barge-loading bucket dredger complete, delivered at Maryport, for the Maryport Harbour Commissioners, to Mr. F. Kelly, clerk of the Commissioners, Harbour Office, Maryport ... ... Aug. 18

Dundalk.—The Dundalk Harbour Commissioners are prepared to entertain applications for supplying a new or second-hand tug, not less than 90 feet long by 18 feet beam; paddle or twin screw; hull of mild steel; if a twin-screw, counters to be well down and broad; one funnel; boiler, mild steel, with pressure of 100 lb.; not less than 60 h.p.; speed not less than 10 knots. Mr. N. Callan, A.M.I.C.E., Harbour Office, Dundalk ... ... Aug. 31

Merthyr Tydfil.—Erection of refuse destructor plant capable of effectually burning 120 tons of refuse per day, together with all buildings and contingent works connected therewith, for the Merthyr Tydfil Urban District Council. Mr. T. Fletcher Harvey, engineer and surveyor to the Council, Town Hall, Merthyr Tydfil Sept. 1

Wolverhampton.—A vertical triple expansion pumping engine and other work connected therewith, for the Corporation of Wolverhampton. Mr. E. A. B. Woodward, waterworks engineer, Town Hall, Wolverhampton ... ... Sept. 1

Last Day.

Southampton.—Supplying and fixing at the Corporation Wharf, Chapel, three 18 in. high-pressure direct-acting centrifugal pumping engines, including all suction and delivery pipes, steam and other connections, for the Corporation. Mr. J. A. Crowther, A.M.I.C.E., borough engineer, Market-chambers, 123, High-street, Southampton ... ... Sept. 4

Bristol.—Construction, delivery, erecting in place. testing, and maintenance for 12 months of pumping machinery for the dry dock now in course of construction at Avonmouth, in the port of Bristol, for the Docks Committee. The contract includes steam engines, centrifugal pumps, steam-boilers, and all auxiliary machinery and piping for the complete installation. Mr. W. W. Squire, Cumberland Road, Bristol. Sept. 11

Bishop's Stortford.—The Urban District Council invite tenders for supplying and fixing gas pumping engine, suction gas plant, and sewage pumps at their sewage pumping station. Mr. Thos. Swatheridge, clerk, Council Offices, 7, North Street, Bishop's Stortford ... ... Sept. 12

COMING CONTRACTS.

Newcastle.—The City Council has adopted an extensive scheme of quay improvement which has been for some time under the consideration of a committee. The total cost is to be £89,000.

Middlesex.—The County Council are about to raise £100,000 temporarily for light railway or other purposes and will make a new issue of county stock to realise £700,000.

Birmingham.—The Electric Supply Committee has recommended the Council to apply for a loan of £99,550 for additional machinery at Summer Lane Station, the extension of sub-stations and cables. The Tramway Bill promoted by the Corporation relates to the building of depôts, the construction of new lines, etc., which will cost about £1,000,000.

Bridlington.—The Council has applied to the Local Government Board for a loan of £4 500 for electric lighting.

Burnley.—An inquiry has been held into the application of the Council for a loan of £16,194 for electricity purposes.

Buxton.—The electrical engineer has submitted particulars of various requirements, including new plant and foundations, the estimated cost being £4,000, and application is to be made to the Local Government Board for its sanction to the necessary loan.

Loch Leven.—A new Scottish lake is to be constructed on Rannoch Moor, Argyllshire. The lake is designed to furnish power for the Loch Leven Water and Electric Power Co., which will be utilised in the manufacture of aluminium. It will be seven miles long, and will be situated about 1,000 ft. above sea-level. It will cost about £500,000.

Yorkshire.—The East Riding County Council have appointed a committee to consider the question of erecting a bridge over the Ouse at Booth Ferry, the estimated cost being £22,000.

Woolwich.—Application is to be made to the London County Council for an advance of £5,610 for a further scheme of street-lighting by electricity.

Macclesfield.—A site is to be purchased in Green-street for the erection of electricity works. The consulting electrical engineer has submitted a scheme and after considerable discussion it has been adopted, and the committee decided to apply for sanction to borrow £16,000 to carry out the undertaking, the principal items of expenditure being: Buildings, etc., £3,500: plant, £7,500; mains, £3,500; connections, £600, and contingencies, £900.

Rawtenstall.—The town council has applied to the L.G.B. for sanction to a loan of £12,000 for carrying out the E.L. scheme.

Rugby.—An inquiry has been held into the application of the Council for a loan of £2,000 for lighting purposes.

CONTRACTS CLOSED.

Gillingham.—Messrs. Babcock and Wilcox have received an order from the Gillingham Council for a water-tube boiler and superheater, at £1,010.

Burma.—The Empire Roller Bearings Company have received an order for 196 axle boxes, fitted with their roller bearings, for twenty-four bogie coaches for use on the Burma Railways.

Manchester.—Messrs. Veritys, Ltd, have obtained the contract for the supply of starting switches to the Manchester Corporation for twelve months. The switches are of the improved "Aston" type.

Hammersmith.—The Guardians have accepted the tender of W. J. Fryer and Co., for wiring and fitting up workhouse and infirmary at Wormwood Scrubbs at £4,580 and also for the supply of two motor transformers and a battery with all accessories at £1,061.

Cardiff.—The Asylums committee have accepted the tender of D. Firth and Co., for an electric lighting installation (wiring, generating plant, etc.) at Whitchurch Asylum at £6,293.

London.—The London County Council have accepted the tender of the General Electric Co., London and Manchester, at £10,129 12s. for high and low-tension switch gear for the Battersea, Clapham, Streatham and Wandsworth sub-stations. The tenderers will be able to sub-let certain portions of the works to Messrs. Ferranti, the British Westinghouse Co. and to W. T. Henley's Telegraph Works Co. Eighteen tenders were received for low-tension switchboards for the Battersea and Wandsworth sub-stations and that of Evered and Co. at £1,347 10s. was accepted.

London.—The Brush Electrical Engineering Company have received an order from the Cadzow Coal Co. for one Birtley-Falcon electric coal cutter.

APPOINTMENTS VACANT.

Newcastle.—City engineer and town surveyor under Corporation. The gentleman appointed will be required to devote the whole of his time to the duties of his office, and not to undertake, or engage in, any other employment. Salary, £800 per annum, rising £100 per annum to £1,000 per annum. Mr. Hill Motum, Town Clerk, Newcastle ... ... August 5

Southern Nigeria.—Telegraph officer, under Crown Agents for the Colonies. Salary £400 with free quarters ... ... August 7

Burma Railway.—Three appointments as temporary assistant engineers in the Way and Works Department in Burma. Salary Rs. 410 per month. Mr. A. G. Begbie, managing director, Gresham House, Old Broad Street, E.C. ... ... August 10

Croydon.—Principal required by Education Committee for polytechnic. Salary £350. Applications to the Clerk ... ... Sept. 11

Liverpool.—Applications invited for the following positions at the University. Assistant lecturer in engineering. Salary £200. Assistant Lecturer and Demonstrator in Engineering. Salary £100. P. Hebblethwaite, Registrar ... ... August 14

Glasgow.—The Governors of the Glasgow and West of Scotland Technical College invite application for the Professorship in the department of engineering in this college. Salary £500. Applications to the secretary ... ... August 21

APPOINTMENTS FILLED.

Auckland.—Mr. Charles Heslop, surveyor to the Shildon Urban District Council, has resigned, in order to take up the position of surveyor to the Auckland Rural District Council.

Leyton.—Mr. F. Schofield, traffic superintendent of the Bradford city tramways, has been appointed general manager of the Leyton tramways. His salary has been fixed at £300 a year.

Leeds.—Mr. J. J. Mann has been appointed for twelve months superintendent of the Leeds Corporation cleansing department, in succession to the late Mr. George Darley. The salary attached to the post is £250 a year.

London.—Dr. A. C. Houston has been appointed director of water examinations under the Metropolitan Water Board, at a salary of £1,000 a year.

Handsworth.—Mr. F. A. Nixon has been appointed chief electrical engineer to Handsworth (Staffs.) District Council at a salary of £350 per annum.

Share List of Engineering, Electrical, Iron and Steel, and other Companies.

The following is a comprehensive list of Companies in the industries covered by "Page's Weekly," in which shares business is being currently transacted. Additions will be made from time to time as occasion requires. We desire it to be understood that while our Share List will generally be found correct, we do not hold ourselves responsible for any loss or inconvenience that may arise from possible inaccuracies.

STOCK EXCHANGE SETTLING DAYS.—Settling days on the Stock Exchange are as follows:—
Consols: Sept. 1st. General Settlements: August 16th, 31st, September 14th. Bank Rate, March 9th, 1905, 2½ per cent

I.—ENGINEERING, IRON, AND STEEL COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
11,370	5	5%	Alldays & Onions Pneumatic Engineering, Ltd.	8	1¾—2¼
10,000	5	3/-	Do. Cum. Pref. 6 per cent. ..	5	4½—5
3,210,000	1	1/-	Armstrong (Sir W. G.), Whitworth and Co., Ltd.	1	3¼—3⅜
76,970	5	2/-	Do. 4% Cum. Pref.	5	5⅜—5⅝
1,500,000	100	4%	Do. 4% 1st Mort. Dbs. Rd.	100	102—104
£100,000	100	4½%	Aveling and Porter, Ltd., 4½% Reg. Mt. Debs. Red.	100	96—99
530,000	1	2/4⅕	Babcock and Wilcox, Ltd., Ord. ..	1	3⅜—3⅝
100,000	1	7⅕d.	Do. „ 6% Cum. Pref.	1	1½—1⅝
20,000	5	3/-	Baker (Joseph) and Sons, Ltd., 6% Cum. Pref.	5	4¾—5¼
250,000	1	6⅗d.	Baldwins, Ltd., 5½% Cum. Pref. ..	1	1—1⅛*
£250,000	Stk	4½%	Do. 1st Mt. 4½% Deb. Stk. Red.	100	102—104
150,000	4½	2/8⅖	Barrow Hæmatite Steel Co., Ld., O.	4½	1 3/16—1 5/16
50,000	4½	3/-	Do. do. Cum 2nd. Pref.	4½	4⅛—4⅜
33,334	5	2/6	Bayliss, Jones and Bayliss, Ltd., 5% Cum. Pref. Shares	5	4¾—5¼
£500,000	100	4½%	Beardmore (Wm.) & Co., Ltd. 4½% 1st Mt. Debs., Red., Scrip 50% pd	—	103—105
50,000	10	6/-	Bell Brothers, Ltd., 6% Cum. Pref.	10	11¾—12¼*
£366,600	Stk	4%	Do 4% Deb. Stock, Red.	100	98—100
200,000	1	1/-	Beyer, Peacock and Co., Ltd., Ord.	1	¼—⅜
300,000	1	6⅗d.	Do. 5½% Cum Pref.	1	9/16—11/16
£300,000	Stk	4½%	Do. 4½% Red. Deb. Stock	100	94—97
1,629,760	1	6d.	Bolckow, Vaughan and Co., Ltd., O. Nos. 1-1,629,760	1	15/16—1
1,860,900	1	3⅗d.	Do. Nos. 1,639,101-3,500,000	12/-	½—9/16
1,160,000	1	10½d.	Brown (John) and Co., Lim., Ord., Nos. 1-1,160,000	15/-	1⅛—1¼
590,000	1	1/2	Do. Ord., Nos. 1,160,001-1,750,000	1	1⅝—1¾
74,000	10	5/-	Do. 5% Cum. Pref.	10	11⅛—11⅜
154,500	5	5/-	Cammell, Laird & Co., Ltd., Ord. ..	5	8⅞—9⅛
232,500	5	2/6	Do. 5% Cum. Pref. ..	5	5½—5¾
450,000	1	1/2⅖	Clayton & Shuttleworth, Ltd., Ord.	1	29/32—31/32
70,000	5	2/6	Do. 5% Cum. Pref.	5	5¼—5½
£250,000	Stk	4%	Do 4% 1st Mort. Db. Stk. Red	100	100—102
100,000	10	7/6	Consett Iron Co., Ltd., Ord.	7½	31½—32½
57 031	10	10/-	Crossley, Bros., Ld., Ord. 40340/97370	10	15⅞—16
40,339	10	5%	Do. 5% Cum. Pref.	10	11¾—11⅞
75,000	1	2/6	Delta Metal, Ltd. Shares	1	2⅛—2⅜
1,259,594	1	3⅗d.	Dorman, Long & Co., Ltd.	1	½—9/16
£400,000	Stk	4%	Do. 4% 1st Mort. Perp. Deb. Stk.	100	87—91
200,000	5	3/-	Dunderland Iron Ore Co., Ltd., 6% Cum. Pref. and Participating..	5	2¾—3¼
250,000	1	9⅗d.	Dunlop (James) & Co., Ltd., Ord...	1	½—⅝
300,000	1	7⅕d-	Do. 6% Cum. Pref. ..	1	⅞-1
4,721	13	13/-	Ebbw Vale Steel, Iron & Coal Co., Ltd.	13	8½—9½
69,754	13	10/-	Do. do. do.	10	6½—7
20,250	10	8/-	Elliott's Metal, Ltd.	8	5—5½
5,000	10	5%	Do. Cum. Pref. 5%	10	8¾—9¼
186,748	Stk	4%	Do. Deb. 4%	100	90—94
25,000	10	6/-	Fairfield Shipbuilding & Engng. Co., Ltd., 6% Cum. Pref. ..	10	10¾—11¼
£250,000	Stk	4½%	Do. 4½% Mort. Deb. Stk. Red.	100	100—103
9,000	10	10%	Fleming & Ferguson, Ltd, Ord. Nos. 1/9000..	10	12¼—12½
6,000	10	5%	Do. 5% Cum. Pref. Nos. 9001/15000	10	9½—10
126,000	3	3/-	Fraser & Chalmers, Ltd., Ord. ..	3	3¾—4¼
21,000	3	1/6	Do. 7½% Cum. Pref.	3	5½—6
10,000	10	5%	Galloways, Ltd., 5% Cum. Pref. 18001/28000	10	6—7
£150,000	Stk	4%	Do. 4% 1st Mort. Deb Red..	100	88½—89½
16,800	10	10/-	Greenwood & Batley, Ltd., Ord. ..	10	7—7½
9,600	10	7%	Do. 7% Cum. Pref.	10	10—10½
965,000	1	1/-	Guest, Keen & Nettlefolds, Ltd. Ord.	1	2 5/16—2 7/16
344,000	5	2/6	Do. 5% Cum. Pref.	5	6¼—6¾
£1,850,500	Stk	4%	Do. 4% Irred. Mort. Deb. Stk	100	104—106
13,000	5	2/6	Gwynnes, Ltd., 5% Cum. Pref. ..	5	2—3
250,000	1	3/6	Hadfield's Steel F'dry Co., Ld., Ord.	1	3 7/16—3 9/16
20,000	10	4/6	Do. 4½% Cum. Pref.	10	10½—11
30,000	5	3/-	Hall (J. & E.), Ltd. 6% Cum. Pref...	5	5—5½*
408,505	1	1/6	Harvey United Steel Co., Ltd. ..	1	1 3/16—1 5/16*
47,500	10	7½%	Hawthorn, Leslie & Co., Ltd. Ord.	10	97—99
28,001	5	7/-	Head, Wrightson & Co., Ltd. ..	5	4¾—5¼
85,000	1	7⅕d.	Hill (Richard) & Co. (1899) Ld., Ord.	1	11/16—13/16
18,000	5	3/-	Do. 6% Cum. Pref.	5	4¾—5
£100,000	Stk	6%	Hornsby (Richard) & Sons, Ld., Ord. 6% Cum. Pref.	100	98—100

ENGINEERING, IRON, AND STEEL COMPANIES.—*Contd.*

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices
750,000	1	7½%	Howard & Bullough, Ltd., Ord. ..	1	1⅝—1¾
25,000	10	6/-	Do. 6% Pref. (Non-Cum.) ..	10	12¾—13¼
£250,000	Stk	4%	Do. 4% Deb. Stk., Red. after 1905	100	95—98
37,500	10	20	Kynoch, Ltd.	10	17—18
49,537	10	5%	Do. Cum. Pref. 5% .. .	10	10½—10⅝
300,000	1	4⅗d	Lambert Bros., Ltd., Ord.	1	⅜—⅝
50,000	5	2/9	Do. 5½% Cum. Pref. .. .	5	4—4½
40,000	8	2/1⅓	Leeds Forge Co, 7% Cum. Pref. ..	8	3¾—4
200,000	1	7⅕d.	Lysaght (John), Ltd., 6% Cum. Pf.	1	1 5/16—1 7/16
£300,000	Stk	4½%	Do 4½% 1st Mt. Deb. Stk., Red.	100	107—109
40,000	10	5/-	Mather & Platt, Ld., 5% Cum. Pref	10	11¾—12
210,000	1	8⅖d.	Measures Bros., Ltd., Ord.	1	½—¾
75,000	1	6⅗d.	Do. 5½% Cum. Pref.	1	¾—⅞
£75,000	Stk	4½%	Do. 4½% 1st Mrt. Db. Stk., Red.	100	92—95
21,943	5	2/6	Muntz Metal, Ltd.	5	4⅞—5⅛
14,248	5	5%	Do. Pref. 5%	5	4⅞—5⅛
5,000	62½	47/6	Nantyglo and Blaina Iron Works, Ltd., 8% Cum. Pref.	62½	79—81
73,000	10	5/-	N. Brit. Loco. Co., Ltd., 5% Cm. Pf.	10	12⅛—12⅜
80,000	5	—	North-Eastern Steel Co., Ltd.,		
£250,000	Stk	4½%	4½% 1st Mrt. Db. Stk., Red.	100	88—91
122,000	5	1/6	Pearson & Knowles Coal and Iron Co., Ltd., Ord., "B"	5	8¼—8¾
50,000	5	3/-	Do. 6% Cum. Pref. "A" ..	5	6¼—6¾
70,000	10	6/-	Pease & Partners, Ltd., Ord. ..	10	9⅞—10¼
£400,000	Stk	4%	Do. 4% Perp. Deb. Stock .	100	98—101
20,000	5	3/-	Peebles (Bruce) & Co., Ld., 6% Cm.P.	5	5—5¼
65,000	1	—	Pooley (Henry) & Son., Ltd., Ord ..	1	6/-—6/6
13,000	5	—	Do. 5½% Cum. Pref.	5	4—4¼
230,000	1	—	Projectile Co. (1902), Ltd., Ord. ..	1	⅜—½
126,938	5	2/-	Rhymney Iron Co., Ltd.	5	1½—1¾*
73,062	5	2/-	Do. New	5	1⅜—1⅝
£330,000	—	5%	Do. 5% Mort. Deb., Red. ..	100	99—101
350,000	1	7⅕d.	Richardsons, Westgarth & Co., Ltd., Ord. 350,001—700,000 ..	1	13/16—⅞
£350,000	1	7⅕	Do. 6% Cum. Pref.	1	⅞—1
£350,000	Stk	4½%	Do. 4½% Perp. Deb. Stock ..	100	93—95
35,000	10	12/-	Ruston, Proctor & Co., Ltd... ..	10	10—10½
275.000	1	6d.	Scott (Walter) Ltd., Ord.	1	⅝—¾
300,000	1	7⅕d.	Do. 6% Cum. Pref. ..	1	13/16—15/16
£300,000	Stk	4%	Do. 4% Perp. Deb. Stk.	100	92—94
£115,300	100	5%	Shelton Iron, Steel and Coal Co., Ld. 1st Charge 5% Debs.. Red ..	100	90—93
£97,900	100	6%	Do. 6% 2nd Mort. Debs., Red.	100	91—95
250,000	1	1/-	South Durham Steel & Iron, Ltd. Or.	1	11/16—13/16
300,000	1	1/2⅖	Do. 6% Cum. Pref...	1	¾—⅞
£300,000	Stk	4½%	Do. 4½% Per. Deb. Stock	100	90—93
49,560	10	2½%	Steel Co. of Scotland Ord. 1/49560..	9	5½—5¾
£125,240	Stk.	5%	Do. 5% Trust Mort. Deb. ..	100	105—106
25,000	10	—	Stephenson (Robert) & Co., Ltd., Or.	10	2⅛—2⅜
25,000	10	5/6	Do. 5½% Cum. Pref. ..	10	4—4¼
£250,000	Stk	4%	Do. 4% Perp. Deb. Stock	100	76—79
85,000	10	9/-	Stewarts & Lloyds, Ltd., Ord. ..	10	17¾—18¼
55,000	10	6/-	Do. 6% Cum. Pref.	10	14¼—14¾
684,732	1	6d.	Swan, Hunter & Wigham-Richardson, Lim. Ord.	1	13/16—15/16
538,845	1	6d.	Do. 5% Cum. Pref.	1	15/16—1 1/16
£240,000	Stk	4½%	Do. 4½% 1st Mort. Deb Stk. Red	100	96—99
300,000	1	6d.	Thames Iron Works, Shipbuilding & Engineering Co., Ltd., 5% Cum. Pf.	1	½—⅝
£200,000	100	4%	Do. 4% Irredeem. 1st Mort. Deb.	100	76—80
£148,500	1	7⅕d.	Thornycroft (John I.) & Co., Ltd. Or.	1	⅝—⅞
£160,000	1	7⅕d.	Do. do. 6% Cum. Pref.	1	15/16—1 1/16
10,000	10	5/-	Tylor (J.) & Sons, Ltd. 5% Cum. Pf.	10	9¼—9¾
$508495200	$100	$½	United States Steel Corp. Com. Stk.	$100	36⅛—36⅜
$360314100	$100	$1¾	Do. 7% Cum. Pref. Stock	$100	106—106⅛
$162268000	$1000	5%	Do. 10-60yr. 5% Skg. Fd. G. Bds.	$1000	98—100
3,350,000	1	1/-	Vickers, Sons & Maxim, Ltd. Ord..	1	2 7/16—2 9/16*
750,000	1	6d.	Do. 5% Non-Cum. Pref. ..	1	1 1/16—1 3/16*
£750,000	Stk	5%	Do. 5% Non-Cum. Pref. Stock.	100	119—122*
£1,250,000	Stk	4%	Do. 4% 1st. Mort. Deb. Stk. Red.	100	104—106
£1,000,000	100	4½%	Do. 4½% 2nd Mort. Debs., Red.	100	105—107
225,000	1	1/2⅖	Weardale Steel, Coal & Coke, Ltd., Def. Ord.	1	13/16—15/16*
500,000	1	7⅕d.	Do. 6% Cum. Pref. Ord. ..	1	15/16—1 1/16
£300,000	Stk	4%	Do. 4% Perpetual Deb. Stock	100	84—87
7,637	5	2/9	Weldless Steel Tube, Ltd., Cum. Pref. 5½	5	4½—4¾
300	Stk	4½%	Do. Mort. Deb. 4½%	100	92—95
66,666	5	3/.	Willans & Robinson, Ord.	5	1—2
66,666	5	3/-	Do. 6% Cum. Pref.	5	2½—3½
£246,641	Stk	4%	Do. 4% 1st Mort. Deb. Stk. Red	100	73—78
£150,000	Stk	4½%	Yorkshire Iron & Coal Co., Ltd., 4½% 1st Mort. Deb. Stk. Red.	100	74—76

Stocks and Shares marked * are quoted ex-dividend.

II.—ELECTRICAL MANUFACTURING COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name	Paid up.	Closing Prices.
70,000	1	6d.	Alliance Elec. Co., Ltd. 5% Cum. Pf.	1	⅝—⅞
125,000	1	7½d.	Aron Elec. Meter Ltd., 6% Cum. Pf.	1	$\frac{7}{16}$—$\frac{9}{16}$
120,000	1	1/2⅔	Bell's Asbestos Co., Ltd.	1	⅞—1
100,000	5	4/-	British Insulated & Helsby Cables Ltd., Ord. ..	5	5½—6
100,000	5	3/-	Do. 6% Cum. Pref.	5	5½—6*
£500,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk. Rd.	100	101—104
£200,000	Stk	4½%	British Thomson-Houston Co., Ltd., 4½% 1st Mort. Deb. Stk. Red. ..	100	100—102
400,000	5	3/-	British Westinghouse Electric and Manufac. Co., Ltd., 6% Pref. ..	5	2⅜—2⅝
£616,353	Stk	4%	Do. 4% Mort. Deb. Stk. Red. ..	100	85—89
105,731	2	2/-	Brush Elec. Enging. Co., Ltd., Ord. ..	2	½—¾
150,000	2	2/4½	Do. 6% Pref.	2	1—1½
£125,000	Stk	4½%	Do. 4½% Perp. 1st Deb. Stk. ..	100	92—95
£125,000	Stk	4½%	Do. 4½% Perp. 2nd Deb. Stk.	100	77—80
85,000	5	7/6	Callender's Cable & Constn. Ltd. Ord.	5	10—11
40,000	5	2/6	Do. 5% Cum. Pref.	5	5½—5¾
£200,000	Stk	4½%	Do. 4½% 1st Mort. Deb Stk. Red.	100	106—108
85,000	3	1/6	Crompton & Co., Ltd...	3	1¾—2*
£100,000	—	5%	Do. 5% 1st Mort. Reg. Debs.	100	94—99%
52,000	5	10/-	Dick, Kerr & Co., Ltd., Ord. ..	5	7¾—8¼
61,000	5	3/-	Do. 6% Cum. Pref.	5	5⅞—6⅛
£300 000	Stk	4½%	Do. 4½% Deb. Stock, Red. ..	100	104—106
283,334	1	6d.	Doulton & Co., Ltd., 5% Cum. Pref.	1	1⅛—1⅜
£233,334	Stk	4%	Do. 1st Mort. 4% Free. Deb. Stk.	100	106—109
99,261	5	1/6	Edison and Swan United Electric Light, Ltd., "A" Shares Nos. 1-99,261	3	1⅛—1⅜
17,139	5	2/6	Do. "A" Shares Nos. 01-017,139	5	2—2½
£344,023	Stk	4%	Do. 4% Deb. Stock Red. ..	100	83—88
£100,000	Stk	5%	Do. 5% Second Deb. Stk. Red.	100	89—94
112,100	2	1/7½	Electric Construction Co., Ltd. .	2	⅜—⅝
31,390	2	2/9⅜	Do. 7% Cumulative Pref. ..	2	1¾—2¼*
£200,000	Stk	4%	Do. 4% Perp. 1st Mt. Deb. Stk.	100	93—96
10,248	10	7/6	Evered and Co., Ltd.	10	10—12
£100,000	Stk	5%	Ferranti, Ltd., 5% 1st Mort. Deb. Stock, Red...	100	90—95
25,000	10	5/-	Gen. Elect. Co. (1900), Ltd., 5% Cum. Pref.	10	9½—10
£200,000	Stk	4%	Do. 4% 1st. Mt. Deb. Stk., Red.	100	97—101
35,000	5	10/-	Henley's (W. T.) Telegraph Works Co., Ltd., Ord.	5	11½—12½
35,000	5	2/3	Do. 4½% Cum. Pref.	5	5⅜—5⅝
£50 000	Stk	4½%	Do. 4½% Mt. Deb. Stk. Red.	100	109—111
50,000	10	5/-	India Rubber, Gutta Percha & Telegraph Works Co., Ltd.,	10	15—16
£300,000	100	4%	Do. 1st Mort. Deb. Red. ..	100	100—103
7,500	10	—	Parker, Thos., Ltd.	10	6½—7
100,000	1	3%	Scott (Ernest) & Mountain, Ld., Ord.	1	16/3—16/9
37,350	12	12/-	Telegraph Construction and Maintenance Co., Ltd.	12	31—33
£150,000	100	4%	Do. 4% Deb. Bonds	100	101—103

III.—ELECTRIC TRACTION.

Present Amount Subscribed	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
120,000	5	5/-	Anglo-Argentine Trams Co., Ld., Or.	5	8⅜—8⅝
260,007	5	2/6	Do. 5% Cum Pf.	5	5⅞—6⅛
£230,000	Stk	6%	Do. Permanent 6% Debenture Stock, 1888 ..	100	141—144
20,000	10	12/-	Barcelona Trams Co., Ltd., Ord. ..	10	13¾—14¼
10,000	10	5/-	Do. 5% Cum Pf. Shares	10	9½—10
£46,300	100	5%	Do. 5% Debs., Red. ..	100	98—101*
£191,326	Stk	4½%	Do. 4½% Red. Deb. Stk.	100	97—102*
75,606	1	—	Bath Elec. Trams. Ld., Pf. Or. ..	1	$\frac{13}{16}$—$\frac{15}{16}$
59,394	1	11·1d	Do. 5% Cum. Pf. ..	1	$\frac{15}{16}$—1$\frac{1}{16}$
75,000	5	—	Brisbane Electric Tram Investment Co., Ltd., Ord.	5	1—1½
75,000	5	2/6	Do. 5% Cum. Pf. ..	5	3¾—4¼
£425,000	Stk	4½%	Do. 4½% 1st Deb. Stk., Red.	100	92—96
£200,000	Stk	6%	Brit. Columbia Elec. Rly. Co., Ltd., Def. Ord. Stock	100	106—109
		5%	Pref. Ord. Stock	100	99—102
133,301	10	6/-	Brit. Electric Traction, Ltd., Ord.	10	8¼—8¾
156,437	10	6/-	Do. 6% Cum. Pref.	10	11—11½
£1,000,000	Stk	5%	Do. 5% Perp. Deb. Stk. ..	100	121—123
£250,000	Stk	4½%	Do. 4% 2nd Deb. Stk. Red. ..	100	97—99
100,000	5	2/6	Buenos Ayres & Belgrano Electric Trams, Ltd., Ord.	5	3—3¼
40,500	5	3/-	Do. "A" 6% Cum Pref. ..	5	5$\frac{7}{16}$—5$\frac{11}{16}$
27,000	5	3/-	Do. "B" do.	5	4⅞—5¼

ELECTRIC TRACTION.—*Contd.*

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
£200,000	Stk	5%	Buenos Ayres Elec. Trams Co. (1901) Ltd., 5% Db. Stk., Red.	100	96—98
£220,000	100	6%	Buenos Ayres Gd. Nat., Ltd., 6% 1st Deb. Bds.	100	100—103
102,268	5	5/-	Calcutta Tramways Co., Ltd. ..	5	9—9½
£350,000	Stk	4½%	Do. 4½% 1st Deb. Stk., Red.	100	106—108
480,000	1	6d.	Cape Electric Tramways, Ltd. ..	1	1⅜—1⅝*
40,000	5	2/6	City of Birmingham Trams Co., Ltd. 5% Cum. Pref.	5	4⅞—5⅛
£300,000	100	4%	Do. 4% 1st Mort. Debs. ..	100	99—102
£120,000	Stk	5%	Colombo Elec. Tram. & Light. Co., Ltd., 5% 1st Mort. Deb. Stk. Red.	100	102—104
60,000	10	6/-	Dublin United Trams. Co. (1896), Ltd., Ord. ..	10	13½—14½*
59,987	10	6/-	Do. 6% Pref...	10	15—16*
30,000	5	2/6	Isle of Thanet Elec. Trams. and Light. Co., Ltd., 5% Cum. Pref.	5	2¾—3¼
£150,000	Stk	4%	Do. 4% Deb. Stock.. ..	100	83—88
125,000	10	5/-	London United Trams. (1901), Ltd., 5% Cum. Pref.	10	9½—10
£1,031,000	Stk	4%	Do. 4% 1st Mort. Deb. Stk. Red.	100	98—101
£50,000	Stk	5%	Madras Electric Trams (1904), Ltd., 5% Deb. Stock, Red.	100	102—104
314,016	1	—	Metropolitan Elec. Trams, Ltd., Def.	1	¼—$\frac{5}{16}$
500,000	1	6d.	Do. 5% Cum. Pref... ..	1	1—1$\frac{1}{16}$
£350,000	Stk	4½%	Do. 4½% Deb. Stock, Red.	100	104—106
50,000	5	6/-	New General Traction Co., Ltd., 6% Cum. Pref.	5	½—1½
110,923	8	3/2⅔	North Metropolitan Tramways Co..	8	4½—5
£150,000	100	3½%	Do. 3½% Mort. Debs.	100	90—95
£196,200	Stk	5%	Perth Electric Trams, Ltd. (W.A.) 5% 1st Mort. Deb. Stock, Red..	100	103—106
24,500	10	10/-	Potteries Elec. Traction Co., Ld., Or.	10	8¾—9¼
24,500	10	5/-	Do. 5% Cum. Pref. ..	10	9¼—9¾
£220,000	Stk	4½%	Do. 4½% Deb. Stk., Red.	100	101—104

IV.—ELECTRIC LIGHTING AND POWER.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
7,500	10	14/-	Bournemouth & Poole Elec. Sup. Co., Ltd., Ord. ..	10	11¾—12¼
7,500	10	4/6	Do. 4½% Cum. Pref. ..	10	10—10½
7,500	10	6/-	Do. 6% Cum. Second Pf. ..	10	11¼—12¼
£70,000	Stk	4½%	Do. 4½% Deb. Stock Red ..	100	106—108
14,000	5	3/6	Bromley (Kent) Elec. Lt. & Pr. Co. Ld	5	5¼—5¾
£50,000	Stk	4½%	Do. do. 4½% 1st Deb. Stk. Red.	100	103—106
27,507	5	5/6	Brompton & Kensington Elec. Supply Co., Ltd. Ord. ..	5	10—10½
12,493	5	3/6	Do. 7% Cum. Pref. Shares..	5	9¾—10¼
60,000	5	5/-	Calcutta Elec. Sup. Cor. Ltd., Ord..	5	9—9½
£288,782	Stk	4%	Central Elec. Sup. Co., Ltd., 4% Gua. Deb. Stk. ..	100	103—106
70,000	5	4/-	Charing Cross & Strand Elec. Sup. Corp., Ltd., Ord... ..	5	6¾—7¼
80,000	5	2/3	Do. do. 4½% Cum. Pref...	5	5¼—5¾
£350,000	Stk	4%	Do. do. 4% Deb. Stk. Red.	100	104—106
41,436	5	3/9	Chelsea Elec. Sply. Co., Ltd., Ord.	5	6—6½
£150,000	Stk	4½%	Do. do. 4½% Deb. Stk., Red	100	108—110
70,595	10	7/-	City of London El. Lghtg. Co., Ld., O.	10	10½—11
40,000	10	6/-	Do. 6% Cum. Pref.	10	13—14
£400,000	Stk	5%	Do. 5% Deb. Stk., Red ..	100	122—126
£300,000	Stk	4½%	Do. 4½% 2nd Deb. Stk., Red	100	103—105
40,000	10	5/-	County of London Elec. Supply Co., Ltd., Ord.	10	8½—9
30,000	10	6/-	Do. 6% Cum. Pref.	10	11¾—12¾
£400,000	Stk	4½%	Do. 4½% Deb. Stk., Red. ..	100	111—114
70,000	5	2/6	Edmundson's Elec. Cor. Ltd., Ord.	5	5¾—6¼
70,000	5	3/-	Do. 6% Cum. Pref.	5	6⅛—6⅝
£300,000	Stk	4½%	Do. 4½% 1st Mort. Db. Stk. Reg	100	105½—107½
£80,000	Stk	5%	Electric Lighting & Traction Co. of Australia, Ltd. 5% Deb. Stk. Red.	100	85—90
10,000	5	/6	Folkestone Elec. Supply Co., Ld., O.	5	5¼—5¾
£50,000	Stk.	4½%	Do. 4½% 1st Deb. Stk., Red.	100	99½—102*
15,000	10	—	Havana Electricity Co., Ltd... ..	10	9—10½
13,000	5	5/-	Hove Elec. Lighting Co., Ltd., Ord.	5	7¾—8¼
£50,000	Stk	4½%	Isle of Wight Electric Light & Power Co., Ltd. 4½% Deb. Stock, Red.	100	100—103
150,000	1	—	Kalgoorlie Electric Power & Lighting Corp, Ltd., 6% Cum. Pref.	1	¾—⅞
21,000	5	5/-	Kensington and Knightsbridge Electric Lighting Co., Ltd., Ord. ..	5	11¼—12¼*

Stocks and Shares marked * are quoted ex-dividend.

ELECTRIC LIGHTING AND POWER.—*Contd.*

Present Amount bscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
£135,000	Stk	4%	Kensington and Knightsbridge Electric Lighting Co., Ltd., and the Notting Hill Electric Lighting Co., Ltd., 4% Deb. Stock, Red.	100	102 —104
111,000	3	1/9⅜	London Elec. Supply Corp., Ld., Ord.	3	1¾ - 2¾
60,000	5	3/-	Do. 6% Pref.	5	5 — 5½
£371,895	Stk	4%	Do. 4% 1st Mort. Db. Stk., Red.	100	99 -102
100,000	10	11/-	Metropolitan Elec. Sup. Co., Ld., Or.	10	9⅛— 10
76,121	5	2/3	Do. 4½% Cum. Pref.	5	5⅜ — 5⅝
220,000	Stk	4½%	Do. 4½% 1st Mort. Db. Sk., Red.	100	109 —113
250,000	Stk	3½%	Do. 3½% Mort. Deb. Stk., Red.	100	98 —100
£250,000	—	4½%	Midland Elec. Corp. for Power Distribution, Ld., 4½% 1st Mort. Deb.	100	99—101%
10,852	10	8/-	Notting Hill Elec. Ltg. Co. Ltd. Ord.	10	14 — 15
£59,000	100	4%	Do. 4% 1st Mort. Debs. ..	100	100 —102
16,500	5	4/6	Oxford Electric Co. Ltd., Ord. ..	5	6½— 7
£50,000	Stk	4%	Do. 4% Debenture Stk. Red.	100	98 —100
£84,700	100	4½%	Royal Elec. Co. (of Montreal) 4½% 20-yr. 1st Mort. Deb	100	101 —104
40,000	5	5/-	St. James' & Pall Mall Elec. Light Co., Ltd. Ord.	5	13 —14¾*
20,000	5	3/6	Do. 7% Pref...	5	8½— 9*
£150,000	Stk	3½%	Do. 3½% Deben. Stock, Red	100	97 —99
12,000	5	4/-	Smithfield Markets Elec. Supply Co., Ltd. Ord.	5	2½— 3
£50,000	Stk	4%	Do. 4% Debenture Stk. Red.	100	76 — 80*
65,000	5	4/-	South London Elec. Sup. Co., Ltd. O.	5	3½ — 4
100,000	1	—	South Metropolitan Elec Light & Power Co., Ltd. Ord.	1	¾ — ⅞
50,000	1	8⅔d.	Do. 7% Cum. Pref.	1	1¼ — 1⅜
£100,000	Stk	4½%	Do. 4½% 1st Deb. Stock Red.	100	106 —109
50,000	5	2/6	Urban Electric Supply Co., Ltd., O.	5	4⅝— 4⅞
30,000	5	2/6	Do. 5% Cum Pref.	5*	5⅛— 5⅜
£200,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk. Red	100	104—106
110,000	5	6/6	Westminster Elec. Supply Corp. Ltd., Ord.	5	11½—12½*
28,151	5	2/6	Do. 5% Cum. Pref.	5	6⅛ —6⅜

V.—TELEGRAPH & TELEPHONE COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
£34,800	100	4%	African Direct Tel. Co., Ld., 4% Mt. Debs. (Series A), Red.	100	98 —101
25,000	10	—	Amazon Telegraph Co., Ld... ..	10	2¼ — 2¾
£763,580	Stk	14/-	Anglo-American Tel. Co.. Ltd., Ord.	100	58 — 60*
£3,118,210	Stk	28/-	Do. 6% Preferred Ordinary	100	105½-106½*
£3,118,210	Stk	2/-	Do. Deferred Ordinary ..	100	13⅞— 14⅛
44,000	5	5/-	Chili Telephone Co., Ltd.	5	7 — 7¼*
$15,000,000	$100	$2	Commercial Cable Co., Capital Stk.	$100	———
£1,903,856	Stk	4%	Do. Sterl. 500-yr 4% Deb. Stk., Red.	100	96½—98½
16,000	10	5/-	Cuba Submarine Tel. Co., Ld., Ord.	10	8½— 9
6,000	10	10/-	Do. 10% Preference	10	17 — 18
6,000	5	2/-	Direct Spanish Telegraph Co., Ord.	5	3⅜— 3⅝
		5/-	10% Cum. Preference	5	9 — 9½
£30,000	50	4½%	Do. 4½% Debs...	50	100-103%
60,710	20	4/-	Direct U.S. Cable Co., Ltd... ..	20	11⅛—11⅜*
£85,800	100	4½%	Direct West India Cable Co., Ltd., 4½% Reg. Debs.	100	99—101
£300,000	100	4%	East. & S. African, Ld., 4% Mt. Dbs.	100	99—101*
£200,000	25	4%	Do. 4% Rg. Mt. Dbs. (Mauritius Subsidy)..	25	101—103%
300,000	10	2/6	Eastern Extension, Australasia and China, Ltd...	10	13¾—14¼
£602,400	Stk	4%	Do. 4% Mort. Deb. Stk., Perp.	100	104½—106½
£4,000,000	Stk	25/-	Eastern Tele. Co., Ltd., Ord. ..	100	143 --146
£2,000,000	Stk	17/6	Do. 3 % Pref.	100	89— 91*
£1,836,814	Stk	4%	Do. 4% Mort. Deb.	100	107 —109
150,000	10	5/-	Great Northern Telegraph Co., Ltd., (of Copenhagen) ..	10	35 —36
£58,700	100	4½%	Halifax and Bermudas Cable Co., Ltd., 4½% 1st. Mort. Debs. Red.	100	99—101
17,000	25	12/6	Indo-European Tele. Co., Ltd. ..	25	51½— 53½
72.680	1	7½d.	Monte Video Telephone Co., Ltd., O.	1	¾— ⅞
£1,983,333	Stk	6%	National Telephone Co., Ltd., Pref.	100	108 —109*
£1,966 667	Stk	5%	Do. Deferred	100	105 —107*
250,000	5	2/6	Do. 5% Non-Cum. 3rd Pref.	5	5¾ — 6*
£2,000,000	Stk	3½%	Do. 3½% Deb. Stk., Red. ..	100	99 —101
£689,593	Stk	4%	Do. 4% do. do. ..	100	102½-104½
179,313	1	8⅔d.	Oriental Telephone & Elec. Co., Ltd.	1	1 3/16— 1 5/16
50,000	1	7⅕d.	Do. 6% Cum. Pref.	1	1⅛—1¼
£100,000	100	4%	Pacific & European Tel. 4% Guar. Debs. Red...	100	97 —100
11,839	8	4/-	Reuter's Telegram Co., Ltd. ..	8	7½— 8
53,000	5	3/-	United River Plate Telep. Co., Ltd.	5	6¾— 7¼
40,000	5	2/6	Do. 5% Cum. Pref.	5	5⅛— 5⅜
£179,947	Stk	5%	Do. 5% Deb. Stock, Red. ..	100	107½—109½
15,609	10	5/-	W. African Telegraph Co., Ltd. ..	10	8½ — 9
£30,008	2½	—	West Coast of America, Ltd. ..	2½	7/16 — 9/16
150,000	100	4%	Do. 4% Deb. Guar. by West. Tel.	100	99 —101

TELEGRAPHS AND TELEPHONES.—*Contd.*

Present Amount Subscribed.	Shares.	Last Dividend.	Name	Paid up.	Closing Prices.
88,321	10	6d.	W. India & Panama Teleg. Co., Ld., Or.	10	½ — ⅝
34,563	10	6/-	Do. 6% Cum. 1st. Pref. ..	10	8— 8½
4,669	10	6/-	Do. 6% Cum. 2nd Pref. ..	10	5¾— 6¼
£80,000	100	5%	Do. 5% Deb.	100	100 —103
207,930	10	3/-	Western Telegraph Co., Ltd. ..	10	13¾—14¼
£75,000	100	5%	Do. 5% Debs., 2nd Series, 1906	100	100 —102
518,915	Stk	4%	Do. 4% Deb. Stock, Red. ..	100	10½ —104

VI.—SHIPPING COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices
32,500	10	5/6	Anchor Line (Henderson Bros.), Ltd., 5½% Cum. Pref.	10	8¾— 9¼
£325,000	Stk	4½%	Do. 4½% Red. 1st Mort. Deb. Stk.	100	99—101
£672,900	Stk	4½%	British & African Stm. Nav. (1900) Ltd., 4½% 1st Mort. Deb. Stk., Red.	100	95 — 97
40,000	10	5/6	Bucknall Steamship Lines, Ltd., 5½% Cum. Pref.	10	5¾— 6¼
£600,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk.	100	87 — 91
£750,000	Stk	4½%	Clan Line Steamers, Ltd., 4½% Deb. Stk. Red. ..	100	99 —101
60,000	20	16/-	Cunard Steam Ship Co., Ltd., Nos. 1-60,000..	20	11¾— 12¼
40,000	20	8/-	Do. Nos. 60,001-100,000	10	4¾— 5¼
£461,430	Stk	4½%	Elder Dempster Shipping, Ltd., 4½% 1st Mort. Deb. Stk. ..	100	100—102
1,200,000	1	6d.	Furness, Withy & Co., Ltd., Ord...	1	1½ — 1⅝
25,328	7½	4/7	Gen. Steam Navigation Co., Ld., Ord.	7½	5 — 5¼
36,758	8	4/9⅜	Do. Non-Cum. 6% Pref.	8	7¾— 8¼
£150,000	Stk	4%	Do. 4% 1st Mort. Deb. Stk. Red.	100	98 —100
55,000	5	1/3	Houlder Line, Ltd., Ord.	5	2¼— 2¾
40,000	5	2/9	Do. 5½% Cum. Pref.	5	2¾— 3¼
£200,000	Stk	4½%	Do. 4½% 1st Mt. Deb. Stk. Red.	100	86 — 88
141,500	10	5/-	Leyland (Fredk.), & Co.. (1900), Ltd., 5% Cum. Pref. ..	10	4 — 4½
£1,160,000	Stk	5 %	Peninsular and Oriental Steam Nav. Co., 5% Cum. Pref. ..	100	128 —131
£1,160,000	Stk	19%	Do. do. Deferred ..	100	224 —227
15,000	100	30/-	Royal Mail Steam Packet Co. Ord..	60	34½— 35½
39,075	5	2/6	Shaw, Savill & Albion, Ltd., 5% Cum. "A" Pref..	5	4¾— 5¼
39,075	5	2/6	Do. "B" Ord...	5	4 — 4½
141,841	10	4/-	Union Castle Mail Steamship Co., Ltd., Ord..	10	8¼— 8¾
24,000	10	4/6	Do. 4½% Cum. Pref... ..	10	10¼— 10¾
£1,008,894	Stk	4%	Do. 4% Debenture Stk., Red.	100	101 —103

VII.—MISCELLANEOUS COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
60,000	1	9⅗d.	Chadburn's (Ship) Tele. Ltd., Ord...	1	1⅛— 1¼
£750,000	Stk	9%	General Hydraulic Power Co., Ltd.	100	126 —131
12,500	10	10/-	Oakey (John) and Sons, Ltd., Ord..	10	24 — 26
10,000	10	6/-	Do. do. 6% Cum. Pf.	10	14 — 15
183,538	1	6·3d.	Power Gas Corp., Ltd., Ord., Nos. 66,463-250	15/-	¼ — ⅜
66,462	1	8·4d.	Do. do. Nos. 1 66,462	1	⅜ — ½
135,000	1	6d.	Waygood (R.) & Co., Ltd., Ord. ..	1	1 1/16 —1 3/16
135,000	1	7⅕d.	Do. 6% Cum. Pref. ...	1	1 1/16 —1 3/16

RAILWAY CARRIAGE & WAGON COMPANIES.

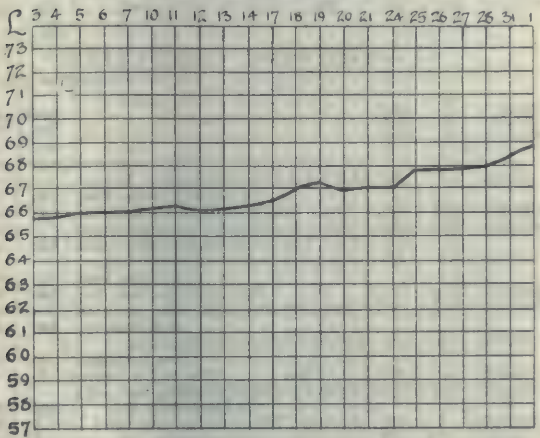
Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
10,000	10	7/6	Birm. Railway-Car, & Wagon, L., 1-10,000	10	22 — 23
8,739	10	3/-	Do. Second Issue 1-8,739....	4	8¼— 9¼
10,000	10	6/-	Do. Cum. Pref. 6% 1-10,000..	10	13¾ —14
30,111	7	7/-	Gloucester Rail.-Car & Wagon, Ld., A, 1-29,861 & 49,751-50,000	7	9½— 10
44,889	7	3/6	Do. B, 29,862-49,750, 50,001-75,000	7	4⅛— 4⅜
14,567	10	1/3	Lancashire Wagon, Ord.	2	2⅜ — 2⅝
4,150	10	5%	Do. do.	10	10½—10¾
784,808	1	9d.	Metropolitan Amalgamated Rail.-Carriage & Wagon, Ld., 1-784,808	1	41/--41/6
164,288	1	6d.	Do. Cum. A Pref. 5% 1-164,288	1	23/6--24/6
235,000	1	7½d.	Do. Cum. B Pref. 6% 1-235,000	1	27/6--28/6*
20,000	20	20/-	Midland Rail.-Car. & Wagon, Ld., 1-20,000	10	19 —19½

Stocks and Shares marked * are quoted ex-dividend.

THE HOME METAL MARKET.

SHOWING DAILY FLUCTUATIONS FROM JULY 3RD TO AUGUST 1ST, 1905.

COPPER.



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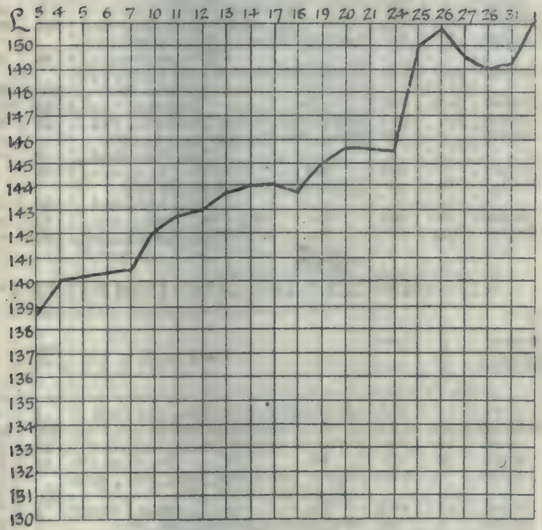
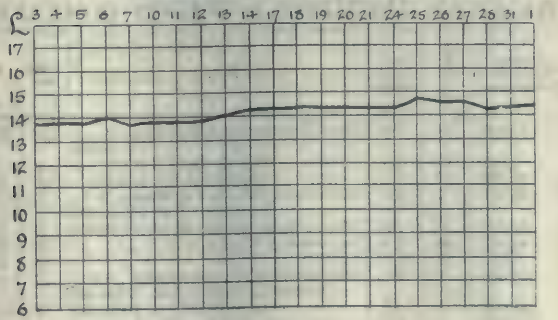
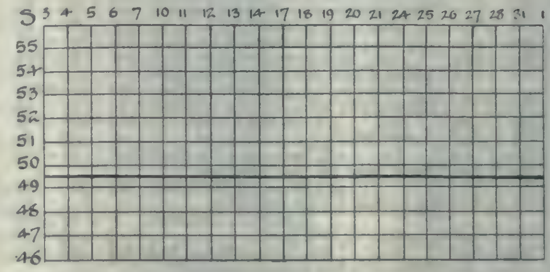


ENGLISH LEAD.



PIG IRON: SCOTCH,



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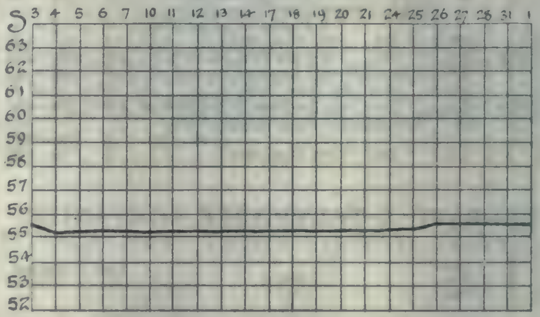
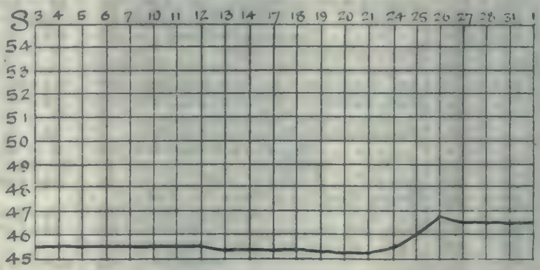
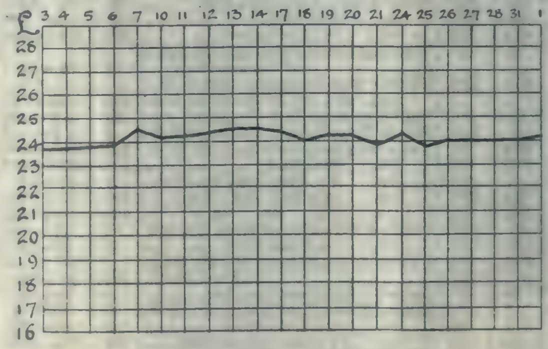


CLEVELAND.



SPELTER.



PRICES CURRENT OF COAL, IRON, STEEL, AND OTHER METALS.

MANUFACTURERS' AND MERCHANTS' QUOTATIONS.

MARKET REPORT.

Wednesday, August 2nd, 1905.

THE improvement recorded in Copper values is the outcome of the strength of tin as much as any intrinsic merits in the position of copper itself. Those best able to judge are, however, of opinion that a sharp rise in the price of copper is likely to take place; and developments during the past day or so rather lend colour to this view. The quotation closes at £68 15s. cash, £69 1s. 3d. three months.

The predominant feature of the week's metal business has been the sensational rise in the price of Tin, business having been transacted at £151, a price, however, which has not been quite maintained. There have been heavy transactions all the week and all attempts to break the market have been quite futile. It is difficult to predict what is likely to be the immediate course of quotations in this section, but with consumption well maintained, and the persistent shrinkage of supplies, operators for the rise have every encouragement to continue the campaign. The market closed yesterday at £150 12s. 6d. cash and £149 12s. 66. for forward delivery.

Firmness still characterises the Lead market, a strong demand for prompt delivery being in evidence. August supplies are restricted, and there appears no reason to anticipate a check in the upward movement of the metal. Soft foreign prompt closes at over £14.

Spelter is the dull spot in the metal market, and is the only section where quotations have shown a tendency to decline. At one time £23 15s. was accepted for August delivery, but the market is now firmer at £23 17s. 6d. to £24 for ordinaries, with specials at £24 10s. to £24 15s.

The improvement noted in the pig iron market last week has made further progress, which is somewhat surprising in view of the increase in Middlesbrough stocks. The buying for the rise has, however, been prompted by encouraging advices from the United States, where a sudden advance in iron and steel products has taken place. In Europe the centre of operations is Germany, but home operators are not altogether disinclined to take a hand in the game. Cleveland is quoted at 46s. 6½d., cash and 46s. 9½d. one month.

IRON, STEEL, PIG-IRON, &c.

SCOTLAND.

Messrs. David Colville and Sons, Ltd., Dalzell Steel and Iron Works, Motherwell, N.B., quote as follows. Prices delivered in Glasgow or equal:—

	Steel:	£	s.	d.
DALZELL	Siemens' Steel Plates, Marine Boiler Quality ..	6	15	0
♛♛	,, ,, ,, Land ,, ,, ...	6	17	6
STEEL	,, Steel Bars, Boiler Quality	6	17	6
DALZELL	Siemens' Steel Plates, Ship Quality Plates......	5	17	6
♛	,, ,, Bars ,, ,, ...	6	7	6
STEEL	,, ,, Angles..................	5	7	6

Manufactured Iron:

		£	s.	d.
Bars—Dalzell	....	6	2	6
,,	Best	6	12	6
,,	,, Horseshoe	6	12	6
,,	Angle....................................	6	2	6
,,	Best Angle	6	12	6
,,	Best Best	7	2	6
,,	Extra Best	7	12	6

Usual terms and extras. Special rates for delivery in England and export. The above prices subject to alteration without notice.

The Glasgow Iron and Steel Co., Ltd., Wishaw, quote as under (prices are delivered Glasgow or equal):—

(Glasgow ♛ Steel)	£	s.	d.	
Steel Angles	5	7	6	per ton.
Steel Ship Plates	5	17	6	,,
Steel Bars, Ship Quality	6	7	6	,,
Glasgow ♛ ♛ Steel.				
Steel Bars, Boiler Quality	6	17	6	,,
Steel Land Boiler Plates	6	7	6	,,
Steel Marine Boiler Plates	6	7	6	,,

Less 5 per cent. discount. Extras as per standard list.

Special prices for delivery in England and for export. The above prices subject to alteration without notice.

John Spencer (Coatbridge), Ltd., Phœnix Ironworks, Coatbridge, N.B., quote:—

		£	s.	d.
Bars—Phœnix	....	6	5	0
,,	Best	6	15	0
,,	Best Best	7	5	0
,,	Extra Best..............................	7	15	0
,,	Best Horse Shoe	6	15	0
,,	Extra B.H.S.	7	15	0
,,	Extra Best Cable	8	5	0
,,	Rivet	6	5	0
,,	Best Scrap Rivet	7	5	0

	£	s.	d.
Angles—Phœnix	6	5	0
,, Best	6	15	0
,, Extra Best	7	5	0
Gas Tube Hoops—Phœnix Best	6	15	0
Plates—Phœnix	—		
,, Best Boiler	7	10	0
,, Best Best Boiler	8	0	0
,, Extra Best Boiler	9	0	0
Boiler Tube Strips—Phœnix Best Best	8	0	0

All per ton, delivered f.a.s., Glasgow, Greenock, Grangemouth, Granton, Leith, or Ardrossan. 5 per cent. discount cash monthly.

Messrs. R. Feldtmann and Co., of Glasgow, quote Commission extra).

Pig Iron :

	No. 1.			No. 3.		
	£	s.	d.	£	s.	d.
Coltness, f.a.s. Glasgow	3	5	0	2	13	0
Gartsherrie ,,	2	17	0	2	12	0
Summerlee ,,	2	17	0	2	12	0
Carnbroe ,,	2	14	0	2	12	0
Langloan ,,	3	0	0	2	15	0
Calder ,,	2	17	6	—		
Clyde ,,	2	16	6	2	11	6
Glengarnock, f.o.b. Ardrossan	2	17	0	2	12	0
Eglinton ,, ,,	2	12	6	2	10	0
Dalmellington, ,, Ayr	—			2	12	0
Shotts ,, Leith	2	17	6	2	12	6

NORTH OF ENGLAND.

Messrs. W. Whitwell and Co., Ltd., Thornaby Ironworks, Stockton, quote as follows, **at works:—**

	£	s.	d.
W.W. ♛ Bars	6	12	6
W.W. Best Bars	7	2	6
W.W. Best Best	7	12	6
W.W. Best Best Best	8	2	6
W. W. Best Shoe	7	2	6
Thornaby ♛	8	2	6
Thornaby Best	8	12	6
Thornaby Best Best	9	12	6
Whitwell Special Admiralty Cable	10	5	0
Special Chain Iron	9	5	0
Tube and Nail Strips	6	15	0
W.W. ♛ Angle Iron	6	15	0
W.W. Best Angle Iron	7	5	0
Tee Iron, to 8-inches United	7	12	6

Terms, Cash, less 2½ per cent. discount on 10th of month following delivery.

LANCASHIRE.

The Pearson and Knowles Coal and Iron Company, Ltd. Dallam and Bewsey Forges, Warrington, quote :—

		Iron.			Steel.		
		£	s	d.	£	s.	d
♛ (BNF)	Bars	6	10	0	6	15	0
	Angles	7	0	0	7	5	0
	Tees	7	10	0	7	15	0
♛ W.I.W	Hoops	7	0	0	7	10	0
	Sheets	7	10	0	8	0	0

Ordinary Sizes, F.A.S. Liverpool in 10-ton Lots.

Extras for Sizes and Cutting as per List.

WORCESTERSHIRE.

Baldwins Ltd. (with which is amalgamated Knight and Crowther, Ltd.), Wilden Works, near Stourport, quote :—

	Singles 20 G 96in. by 36in. per ton.			Doubles 21 G to 24 G 96in. by 36in. per ton.		
Black Sheets	£	s.	d.	£	s.	d.
"Vale"	10	0	0	10	10	0
"Shield"	10	10	0	11	10	0
"Severn"	11	10	0	12	10	0
"Baldwin Wilden B."	12	10	0	13	10	0
Charcoal	16	10	0	17	10	0
Best Charcoal	18	10	0	19	10	0

Pickled, cold-rolled and close annealed sheets specially quoted for.

Extra widths, Singles to 66in., Doubles to 56in., Lattens to 46in. Extra lengths, Singles to 168in., Doubles to 132in., Lattens to 108in.

Patent Coated Sheets:

	£	s.	d.	£	s.	d.
No. 3 Lead	13	10	0	14	10	0
S.V. Lead	15	0	0	16	0	0
No. 3 Terne	15	0	0	16	0	0
S.V. Terne	16	10	0	17	10	0

	Singles 20 G to 108 by 36in. per ton.			Doubles 21 to 24 G to 96 by 36in. per ton.		
Tinned Sheets:	£	s.	d.	£	s.	d.
Best Coke (Finish)	29	0	0	30	10	0
,, Charcoal (Finish)	31	0	0	32	10	0
Extra ,, ,,	33	0	0	34	10	0

Cotton Can Tin Sheets to 39in. by 36in. specially quoted for.

Tin Plates, "Cookley, K" Best Charcoal, £1 7s. 0d. per box.

Extreme sizes in Tin and Patent Coated specially quoted for.

Lattens up to 36 wide by 27 W.G. £1 10s. 0d. per ton extra throughout for all brands.

At works.

Galvanized Corrugated Sheets:

	£	s.	d.	
"Phœnix" Brand, 24 G., f.o.b. London, in Bundles	12	0	0	per ton.
"Blackwall" Brand, 26 G., in felt-lined cases for Australia, f.o.b. London	14	5	0	,,

Galvanized Working Up-Sheets:

	£	s.	d.	
24 G., f.o.b. London, in Bundles	13	0	0	per ton.

STAFFORDSHIRE.

Shelton Iron, Steel, and Coal Co., Ltd., Stoke-on-Trent, North Staffordshire, and 122, Cannon Street, London, quote :—

	£	s.	d.	
Crown Bars	6	10	0	per ton.
Best Bars (1 to 6in. wide, above ¼ in. thick, ½ in. to 4 rounds and squares)	7	0	0	,,
Angles	6	15	0	,,
,, Best	7	5	0	,,
T's	7	0	0	,,
,, Best	7	10	0	,,
Best Shoe Iron	8	0	0	,,
,, Rivet Iron	8	0	0	,,
,, Best Rivet (Special)	9	5	0	,,
,, Cable	9	5	0	,,
,, Screwing	8	5	0	,,

	£	s.	d.	
Best Turning	8	0	0	per ton.
,, Plating	8	5	0	,,
Best Best	9	5	0	,,
Treble Best	10	5	0	,,
Plates	7	10	0	,,
Best Plates	8	0	0	,,
,, Boiler Plates	8	10	0	,,
,, Best Boiler Plates	9	10	0	,,
Treble Best Boiler Plates	12	0	0	,,

Delivery f.o.b. Liverpool, Birkenhead or Manchester.

WALES.

Cordes (Dos Works), Ltd., of Newport, Mon., quote "Star" brand patent wrought nails steel nails, &c.

Discounts—

45 per cent. off 1-inch to 3-inch strong rose and all fine rose and 6dy. and 8dy. pound.

40 per cent. off 3½-inch to 7-inch strong rose and 10dy. and 20dy. pound.

40 per cent. off all sharp-pointed nails.

Delivered in lots of 4 cwt. and upwards. Extra 2½ per cent. discount off the gross on two tons and upwards.

Steel rose, flat points, 5-inch to 7-inch basis:—

2 tons 9/6 per cwt.
4 cwt. lots and upwards 9/9 per cwt.
} d/d any Railway Station.

Steel cut nails, 3-inch basis—

2 tons 8/3 per cwt.
4 cwt. lots 8/6 per cwt.
} d/d any Railway Station.

Slit rods (iron) £7 10s. per ton, at works for 2-ton lots.

Messrs. Richard Thomas and Co., Ltd., of 33 and 35, Eastcheap, E.C. — Works: South Wales, Burry, Lydney, Lydbrook, and Cwmbwrla, quote:—

	Per Box. f.o.b. Wales. £	s.	d.
Coke Tin-plates.			
C 18¾ by 14 124s. 110 lb. "BV"	0	12	1½
C 20 by 10 225s. 155 ,, "Jumbo"	0	17	3
C 20 by 14 112s. 108 ,, "Lydbrook"	0	11	10½
C 28 by 20 112s. 216 ,, "Lydbrook"	1	4	0
Charcoal Tinplates:			
C 20 by 14 112s. 108 lb. "Allaway"	0	12	7½

BELGIUM.

C. L. Faulkner, Suffolk House, Laurence Pountney Hill, London, E.C., quotes:—

Prices quoted are in £ stg. and per ton of 1,015 kos. (2,240 lb.) delivered free on board ANTWERP for approved quantities.

		£	s.	d	
Steel:					
Blooms	at	3	16	0	per ton.
Billets	at	3	18	0	,,
Sheet Bars	at	4	0	0	,,
Finished Steel:					
Bars	at	4	19	0	per ton.
Angles	at	5	0	0	,,
Tees	at	5	3	0	,,
Joists	at	4	10	0	,,
Fencing Standards	at	5	2	0	,,
Shoeing Bars	at	5	5	0	,,
Tyre Bars	at	5	5	0	,,
Half-Round Bars	at	5	10	0	,,
Heavy Rails	at	5	5	0	,,
Light Rails	at	4	17	6	,,

Structural Steelwork:

Prices on application.

METALS.

Messrs. French and Smith, 147, Leadenhall Street, and 11, Oldhall Street, Liverpool, quote:—

TIN.

Tin:	£	s.	d.		£	s.		
English Ingots, f.o.b. Dis. 1½% & 1%	150	10	0	to	151	0	0	per ton
English Bars, f.o.b. Dis. 1½% & 1%	151	10	0	to	152	0	0	,,
Straits G.M.B., cash Warehouse, Net	150	15	0	to	150	17	6	,,
Straits G.M.B., 3 months, Warehouse, Net	149	10	0	to	149	15	0	,,
Australian, Mt. Bischoff, Warehouse, Net	152	0	0	to	153	0	0	,,

COPPER

Copper:	£	s.	d.		£	s.	d.	
Standard G.M.B., cash Warehouse, Net	68	15	0	to	68	17	6	per ton.
Standard G.M.B., 3 months, Warehouse, Net	69	0	0	to	69	1	3	,,
English, Tough, Cake & Ingot, Warehouses, Net	71	10	0	to	72	0	0	,,
English, Best Select, Warehouse Net	72	15	0	to	73	5	0	,,
English, Sheets and Sheathing, f.o.b., Dis. 2½%	81	0	0	to	82	0	0	,,
English, Sheets for India, f.o.b., Dis. 2½%	77	0	0	to	78	0	0	,,
Electro, Warehouse, Net	72	5	0	to	72	10	0	,,
Ore, ex. ship	0	12	0	to	0	13	0	per unit
Regulus, Matte and Precipitate, ex ship,	0	13	3	to	0	13	9	,,

YELLOW METAL.

Yellow Metal:	£	s.	d.	
Sheets, 4 by 4 feet for India f.o.b. Dis. 2½%	0	0	6⅜	per lb.
Sheathing ,, ,,	0	0	6½	,,

SPELTER.

	£	s.	d.		£	s.	d.	
Silesian outports, Net	23	17	6	to	24	0	0	per ton.
Blende of 50 % Net	6	13	6	to	6	14	6	,,
Calamine, Net	6	16	0	to	6	17	0	,,

LEAD.

	£	s.	d.		£	s.	d.	
English Pig, Warehouse, Dis. 2½%	14	5	0	to	14	7	6	per ton.
Spanish, ex ship, Dis. 2½%	13	17	6	to	14	0	0	,,
Lead Ore of 70 %, Net	7	2	6		7	5	6	

ANTIMONY.

	£	s.	d.		£	s.	d.	
Star Regulus, f.o.b., Dis. 2½ %	60	0	0	to	61	0	0	per ton.
Ore, 50 %, ex ship, Dis. 2½%	15	10	0	to	16	10	0	,,
Crude, ex ship, Dis. 2½ %	35	0	0	to	37	0	0	,,

QUICKSILVER.

	£	s.	d.	
Spanish, 75 lb., Warehouse, Net	7	7	6	per flask
Italian ,, ,, ,,	7	5	6	,,

COAL.

LEICESTERSHIRE.

The Nailstone Colliery Company, Leicester, quote. Price per Ton at Pit of 20 Cwt., with ½ Cwt. per Ton for wastage —

Upper Main Seam.

	s.	d.
Main Coal	6	0
Best Hard Steam (hand picked, as used by the Railway Companies)	5	6
Best Hard Steam Cobbles (made through 6 in. mesh, free from slack)	5	6
Fine Slack	0	6

Terms, net cash on 10th of month following delivery.

DERBYSHIRE.

The Manners Colliery Co., Ltd., of Ilkeston quote as follows, per ton at pit:

Kilburn Coal:

	s.	d.
Best London Brights	9	9
Large Nuts (1½ to 3¼)	9	6
Small Nuts (¾ to 1½)	6	0
Rough Brights	6	0
Peas (⅜ to ¾)	5	0
Slack	3	6
Smudge	2	0

Low Main (or Tupton) Coal:

	s.	d.
Low Main Brights	7	6
,, ,, Nuts	7	3
Hards (Good Steam Coal)	8	0
Bakers' Nuts (1" to 2")	6	6
Slack	3	6

The Clay Cross Company's Collieries, Clay Cross, near Chesterfield, quote:—

	per ton at pit. s.	d.
Best Main Coal	10	6
Best Silkstone	10	0
Best House Coal	8	6
Best House Nuts	8	0
Treble Screened Cobbles	7	9
Best Cobbles	7	3

NOTTINGHAMSHIRE.

The Digby Colliery Co., Ltd., near Nottingham, quote per ton at pit:—

Digby Coal:

STEAM.

	s.	d.
Best Hand Picked Hard	8	6
Steam Hard	7	3
Hard Nuts	6	6

Gedling Colliery.

HIGH HAZEL.

	s.	d.
London Brights, 4 to 8 in. cube	9	6
Bright Cobbles (Hand Picked)	9	0
Large Nuts, 2 to 4 in. cube	8	0
Small Nuts, 1 to 2 in. cube	6	0
Pea Nuts, ⅜ to 1 in. cube	5	0

STEAM.—TOP HARD.

	s.	d.
Best Hard	8	6
Hard Steam	7	6
Cobbles	6	3

CHEMICALS.

Messrs. S. W. Royse and Co., Albert Square, Manchester, quote:

		£	s.	d.	
Acids:	Oxalic	0	0	2½	per lb.
	Picric, Crystals	0	0	10	,,
	Tartaric at Manchester	0	0	10⅞	,,

		£	s.	d.	
Acetate of Lime:	Brown at Manchester net	8	10	0	per ton.
	Grey ,,	11	12	6	,,
Alumina:	Alum, Lump, loose	5	5	0	,,
	,, ,, in casks	5	7	6	,,
	,, Ground, in bags	5	15	0	,,
	Sulphate of Alumina, 14%	4	10	0	,,
Ammonia:	Carbonate	0	0	3⅝	per lb.
	Muriate Grey f.o.b. Liverpool	23	15	0	per ton.
	Sal-ammoniac, Lump, 1sts, del^d. U.K.	42	0	0	,,
	,, ,, 2nds, ,,	40	0	0	,,
	Sulphate f.o.b. Liverpool	12	17	6	,,
Arsenic:	Best White Powdered net	12	5	0	,,
Bleaching Powder,	35% ,,	4	10	0	,,
Borax:	British Refined Crystal ,,	12	0	0	,,

Coal Tar Products:

		£	s.	d.	
Benzole, 50/90 %	,,	0	0	6	per gal.
,, 90%	,,	0	0	7	,,
Carbolic Acid Crystals, 34/35° C.	,,	0	0	6¼	per lb.
,, ,, ,, 39/40° C.	,,	0	0	6½	,,
,, ,, Liquid, 97/99 %	,,	0	0	9	per gal.
,, ,, Crude, 62½% at 60° F. f.o.b.	,,	0	1	9	,,
Creosote, ordinary good liquid	,,	0	0	1½	,,
Naphtha, Crude, 20 % at 120° C.	,,	0	0	3	,,
,, Solvent, 90% at 160° C. f.o.b	,,	0	0	8	,,
,, ,, 95 % at 160° C. ,,	,,	0	0	9	,,
,, ,, 90 % at 190° C. ,,	,,	0	0	10	,,
,, Rectified, flash point over 73° F. f.o.b.	,,	0	0	11	,,
,, Rectified, flash point over 100° F. f.o.b.	,,	0	1	0	,,
Naphthalene, all qualities.					
Pitch f.a.s. Manchester.	,,	1	7	6	per ton.

		£	s.	d.	
Copperas:	Green, in bulk ,,	0	12	6	,,
	,, barrels f.o.b. L'pool ,,	1	17	6	,,
	Cake ,,	1	2	6	,,
Copper:	Sulphate	21	0	0	,,
Cyanides:	98% minimum f.o.b. net	0	0	7½	per lb.
Lead:	Acetate (Sugar) White, English	27	10	0	per ton.
	,, ,, ,, Foreign c.i.f. U.K	23	5	0	,,
	,, ,, Grey	21	15	0	,,
	,, ,, Brown at Manchester	16	15	0	,,
	Nitrate	24	10	0	,,
	Litharge, Flake	15	10	0	,,
	,, Powder	16	0	0	,,
	Red Lead, Genuine, c.i.f. London less 5%	15	10	0	,,
	White ,, ,, Dry ,, ,, ,,	16	15	0	,,
Naphtha (Wood):	Miscible, 60 o.p.	0	2	6	per gal.
	Solvent	0	2	7	,,
Potash:	Bichromate... delivered England	0	0	3	per lb.
	Carbonate, 90/92 % ... c.i.f Hull	18	5	0	per ton.
	Caustic, 75/80 % ,, ,,	20	10	0	,,
	Chlorate net	0	0	3 1/16	per lb.
	Montreal in Store, Liverpool	31	10	0	per ton.
	Prussiate, Yellow net		0	4⅞	per lb.

		£	s.	d.	
Soda:	Ash, Caustic, 48 %, Ordinary ... net	5	5	0	per ton.
	,, ,, ,, Refined...... ,,	6	5	0	,,
	,, Carbonated, 48 %........... ,,	5	10	0	,,
	,, ,, 58 % (Ammonia Alkali) ....net	4	10	0	,,
	,, Bleachers' Refined Caustic 50/52 % .... net	6	10	0	,,
	Caustic, White, 77 %............... ,,	10	12	6	,,
	,, ,, 70 %............... ,,	9	12	6	,,
	,, ,, 60 %............... ,,	8	12	6	,,
	,, Cream, 60 %..... .... ,,	8	10	0	,,
	Crystals, in bags	3	0	0	,,
	,, barrels	3	7	6	,,
	Acetate .... c.i.f. Hull net	16	12	6	,,
	Bicarbonate, in 1 cwt. kegs............	6	15	0	,,
	Bichromate......delivered England...	0	0	2¼	per lb.
	Chlorate .... net	0	0	3$\frac{1}{16}$	per lb.
	Nitrate.. ex quay Liverpool, ... ,,	10	0	0	per ton.
	Phosphate	9	5	0	,,
	Prussiate ....net	0	0	3⅝	per lb.
	Silicate, Solution, 140° Tw.	4	10	0	per ton.
	Sulphate (Glauber Salts)................	1	12	6	,,
	,, (Saltcake, 95%)................	1	15	0	,,
Sulphur:	Recovered	4	15	0	,,
	Roll	6	15	0	,,
	Flowers....................................	7	10	0	,,
Zinc:	Sulphate	6	15	0	,,
Shellac:	Standard TN orange spot	9	0	0	per cwt.

MINERALS.

Messrs. S. W. Royse and Co., quote :—

		£	s.	d.	
Barytes:	Lump Carbonate, 90/92%	3	10	0	per ton.
	Sulphate, No. 1, White	2	15	0	,,
China Clay:	of various qualities for all purposes; prices from about 11/- to about 30/- per ton, f.o.b. Cornwall: stocks also kept at Runcorn and Preston. Quotations given carriage paid.				
Chrome Ore:	Basis 50% c.i.f. British Ports..........	3	10	0	,,
Manganese:	Lump c.i.f. Liverpool 10¼d.	per metallic unit.			
Ochre:	French JC .... f.o.b. Rouen, net	2	5	0	per ton.
	,, JF	5	10	0	,,
Talc:	(French Chalk).........c.i.f. Liverpool	3	10	0	,,

Messrs. Henry Bath and Son, quote :—

	£	s.	d.		£	s.	d.	
Copper, Ores of, 10 to 25%	0	12	0	to	0	13	0	per unit.
Regulus, 45 to 55%	0	13	3	to	0	13	9	,,
Precipitate, 65 to 80% ...	0	13	4½	to	0	13	10½	,,
Tin Ores, 70 %..............	91	0	0	to	93	0	0	per ton.
Lead Ore, 70%					6	19	0	,,
Blende, 50%					6	9	6	,,
Calamine........................					6	12	0	
Antimony Ore, 50%......	20	0	0	to	22	0	0	,, nom.

Messrs. Barrington and Holt, Cartagena, quote :—

Iron Ore.

			s.	d.	
Ord. 50%, ...	f.o.b.	Porman	6	4	per ton.
Do.	,,	Cartagena	6	7	,,
Special low phos.	,,	Porman	6	10	,,
Do. do.	,,	Cartagena.............	7	0	,,
Extra quality do.	,,	,, ...	7	6	,,
Special Iron Ore	,,	,, ...	nominal		,,
Specular 58% do.	,,	,, ...	9	6	,,

TIMBER.

Messrs. Alfred Dobell and Co., Liverpool, quote :—

COLONIAL WOODS.

Timber.

		£	s.	d.		£	s.	d.
Quebec Square White Pine...	per cub. ft.	0	1	9	to	0	3	3
Quebec Waney Board Pine...	,,	0	2	8		0	3	9
St. John Pine, 18 in. average	,,	0	2	4		0	3	3
Lower Ports Pine...............	,,	0	1	3		0	1	8
Quebec Red Pine	,,	0	1	6		0	2	3
Quebec Oak, 1st quality	,,	0	2	9		0	3	4
Quebec Oak, 2nd quality ...	,,	0	1	6		0	2	6
Ash	,,	0	1	6		0	2	3
Elm	,,	0	3	3		0	4	0
Hickory	,,	0	2	0		0	2	6
Quebec Birch	,,	0	1	6		0	2	8
St. John Birch	,,	0	1	6		0	2	0
Birch Planks......................	,,	0	0	9		0	0	11
Spruce Spars	,,	0	0	10		0	1	0

Deals.

		£	s.	d.		£	s.	d.
1st quality Quebec Pine	per std.	22	10	0	to	32	10	0
2nd do. do.	,,	17	0	0		22	0	0
3rd do. do	,,	11	10	0		13	0	0
St. John, Miramichi, etc., Spruce	,,	7	2	6		7	7	6
Nova Scotia Spruce..	,,	7	0	0		7	5	0
Spruce Boards................	,,	6	7	6		6	12	6

UNITED STATES, etc., WOODS.

Pitch Pine.

		£	s.	d.		£	s.	d.
Hewn	per cub. ft.	0	1	4	to	0	1	8
Sawn	,,	0	1	0		0	1	6
Planks, Stowage	,,	0	0	10		0	1	0
Boards, Prime	per std.	12	10	0		16	0	0
Oak Timber	per cub. ft.	0	1	6		0	2	6
Oak Planks	,,	0	1	6		0	2	1
East India Teak..............	per load	12	0	0		16	0	0
Greenheart.....	,,	6	15	0		7	10	0

EUROPEAN WOODS.

Timber.

		£	s.	d.		£	s.	d.
Riga Redwood	per cub. ft.	0	1	6	to	0	2	0
Dantzic and Memel Fir, Crown	,,	0	2	1		0	2	6
Dantzic and Memel Fir, Middling	,,	0	1	9		0	1	11
Stettin	,,	0	1	9		0	1	11
Swedish	,,	0	1	0		0	1	3
Riga Whitewood	,,	0	1	0		0	1	3
Norway Mining Timber	,,	0	0	9		0	1	0
Dantzic and Stettin, etc., Oak..	,,	0	2	6		0	3	0
Norway Spars.................	,,	0	1	2		0	1	9

Deals.

		£	s.	d.		£	s.	d.
Red Archangel and Onega, 1st quality	per std	19	0	0		20	0	0
Red Archangel and Onega, 2nd quality	,,	14	0	0		16	0	0
Red Archangel and Onega, 3rd quality	,,	10	10	0		12	10	0
St. Petersburg, 1st quality...	,,	16	0	0		17	10	0
Do. 2nd ,, ...	,,	14	0	0		15	0	0
Gefle	,,	11	10	0		16	0	0
Wyburg	,,	11	0	0		12	10	0
Uleaborg	,,	10	0	0		12	10	0
Gothenburg	,,	11	0	0		16	0	0

SELECTED PATENTS.

Compiled expressly for this journal by **Messrs. Page and Rowlingson, Engineering Patent Agents, 28, New Bridge Street, London, E.C.,** and at Manchester.

Copies of Specifications may be obtained at the Patent Office Sale Branch, 25, Southampton Buildings, Chancery Lane, W.C., at the uniform price of 8d.

NEW PATENTS APPLIED FOR.

When Patents have been communicated the names of the communicators are printed in *italics.*

14671. F. Clennell and F. W. Thorp, London. July 17th.—Improvements in or relating to ship's propellers.

14680. R. Lorenz, London. July 17th.—Wire-drawing machine. (Date applied for, July 18th, 1904.)

14682. M. H. De Hora and R. D. Wilkinson, London. July 17th.—Improvements in or relating to wheels of motor-cars, carts, 'buses, wagons, and other wheeled vehicles.

14684. F. Casey and E. W. Hubbard, London. July 17th.—Improvements in pump or suction dredging machinery.

14685. J. Grummett, London. July 17th.—Improvements in bodies of motor cars.

14686. G. Lucas, London. July 17th.—Improvements in conveyors.

14703. H. Rose and J. Ritchie, London. July 17th.—An improved coupling for railway and other rolling stock.

14704. O. Wieczorek, London. July 17th.—A new or improved air turbine.

14706. T. Whittle, London. July 17th.—Improvements in and connected with ship's progress indicators.

14732. W. R. Marshall and T. Hargreaves, Keighley. July 18th.—Improvements in smoke consuming apparatus for the furnaces of steam generators.

14739. H. J. Fenner and W. G. Fenner, Hull. July 18th.—Improvements in or relating to driving belts.

14744. J. Potter, Sampford Courtenay. July 18th.—Turbine wheel for steam, gas, or water.

14764. H. J. Wagg, London. July 18th.—Improvements in or relating to submarine vessels.

14777. T. Aspinall, London. July 18th.—Improvements in or relating to means for preventing or minimising loss of life in submarines or like sunken vessels, and in enclosed chambers.

14804. I. A. Timmis, London. July 18th.—Improvements in the means employed for getting more perfect combustion of fuel in the fire chambers of boilers.

14848. W. L. Byers, London. July 19th.—Improved means of replenishing the air supply of submarine boats or vessels when submerged or sunken.

14852. G. Boggis, A. Orr, and M. Corry, Belfast. July 19th.—A steam regulating system for locomotives and other engines.

14859. S. Creek, London. July 19th.—A new or improved nut lock.

14860. A. G. Eversfield, London. July 19th.—A new or improved device for regulating the tension of power transmitting belts and the like.

14902. G. T. Guyon, Richmond. July 20th.—Improvements in and relating to valves, cocks, and pumps.

14904. T. G. Wilks, Stockton-on-Tees. July 20th.—Improvements in connection with refloating submarines torpedoes, or the like vessels intended to float.

14932. J. D. Anglin, London. July 20th.—An improved method for liberating men from a submarine boat in the event of it being unable to rise to the surface.

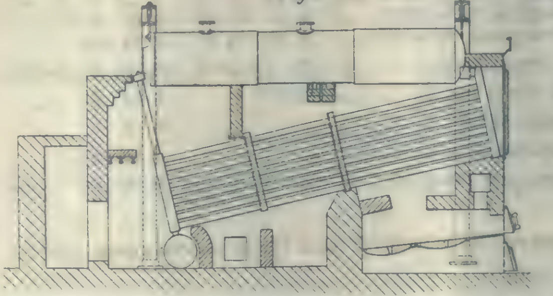
14943. V. H. B. Reynardson, London. July 20th.—Improvements relating to submarine vessels.

RECENT SPECIFICATIONS.

IMPROVEMENTS IN FURNACES AND COMBUSTION CHAMBERS OF STEAM BOILERS.

T. Bamforth and R. P. Roy, Carron, Stirlingshire. June 22nd, 1905.—This invention relates to the furnaces and combustion chambers of steam boilers of the water-tube type, and it has for its object to lessen the production of smoke while improving the evaporation of the boiler. The invention is illustrated in the accompanying drawings, in which fig. 1 is a sectional elevation of a water-tube boiler of the Babcock and Wilcox type, showing the improvements applied to the furnace and combustion chamber thereof. Fig. 2 is a cross section to a larger scale, showing the crown of the combustion chamber; fig. 3 is a horizontal section of fig. 2, and as shown by these drawings, an arch, or baffle of brick, or other material is built under the steam and water-drum or crown of the furnace, but over the circulating water-tubes, and above the usual vertical or inclined baffle over the bridge, which deflect the fire gases which rise from the furnace across the rows of

Fig 1.



tubes, the said arch or supplementary baffle being made hollow, as indicated at figs. 3 and 4, and arranged to admit cold or heated air, which enters through ducts and pipes to complete the combustion of such of the fire gases as are only partially consumed, and thereby provide a fresh volume of flame to impinge on the circulating tubes as the gases pass downward between the ordinary baffle devices; or steam, or gaseous, or liquid fuel may be admitted through the archway in lieu of air, or in addition thereto. A baffle wall is also built above the normal ground level under the usual depending baffle, which extends across the water-circulating tubes behind the bridge wall, and a further baffle or arch may be built across the rear wall of the combustion chamber, these baffling walls being provided to prevent the heated gases passing through the boiler too quickly. They may be also made hollow to admit air, or liquid, or gaseous fuel.

Fig 2

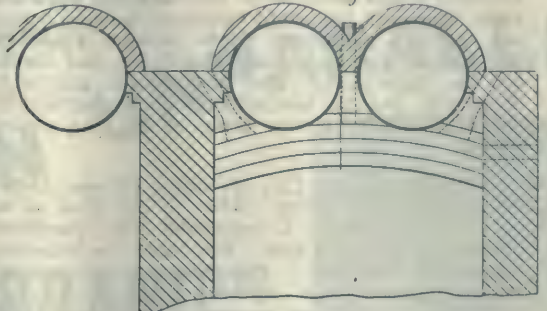
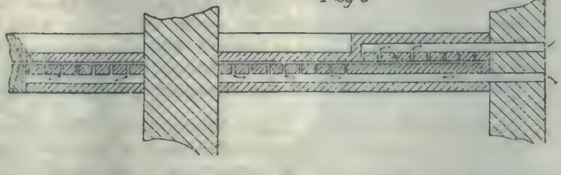


Fig 3.



IMPROVEMENTS IN AND RELATING TO AUTOMATIC COUPLING DEVICES FOR RAILWAY AND SIMILAR VEHICLES.

A. B. Ibbotson, Florence, Italy. June 15th, 1905.—The invention relates to the automatic coupling of what are known as three link coupling chains and screw couplings, which latter may be screwed up before setting for coupling in connection with ordinary or special coupling hooks for coupling railway vehicles together, to act as substitutes for the said coupling links and chains, such as now are in use, which may be operated automatically when the empty hook of an incoming vehicle is coming into contact therewith without rendering it necessary to ascertain beforehand the difference in height, above the rails, of the said empty hook of the incoming vehicle in respect to the stationary vehicle. One important feature of some of the improved links is in what is called the "central" or "intermediate" hinge, as shown in the drawings, which may be arranged at equal distances from the extreme ends of the link, or may vary in position according to the kind of coupling for which it is required. This intermediate hinge is so constructed that the centre of its central or intermediate hinge pin, even when the whole link is pulled into as straight a line as possible, will not necessarily be quite in a direct line or level between the centres of the two pulling ends of the complete link. Stops are provided on the underside of the intermediate hinge to prevent that hinge from rising upwards, or on the upper side thereof to prevent it dipping downwards under end-on compression, according to the requirements, and more particularly in order that no one of the said links can be made to bend in both directions with end-on compression when fixed. When the aforesaid central hinges are used, especially when they are arranged to rise upwards under end-on compression between vehicles, it is an advantage to attach to such hinges sufficiently strong springs to keep both ends of the links as much as possible in line with each other until coupling has been effected. Figs. 1 and 4 show the links pulled out and compressed. In a modification of this invention, a handled lever tool is provided for uncoupling by hand, as illustrated in figs. 5 and 6, while the vehicles are being compressed together, which enables any workman to effect the uncoupling of any of the single links above described in a moment from the outside of either of the vehicles, which tool the operator can equally well apply at his right or left hand to the side of the coupling hook, which contains either the main hinge or coupled end of one of these links.

Fig. 1.

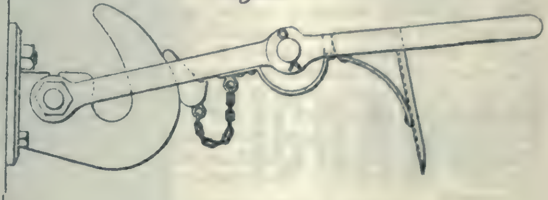


Fig. 2

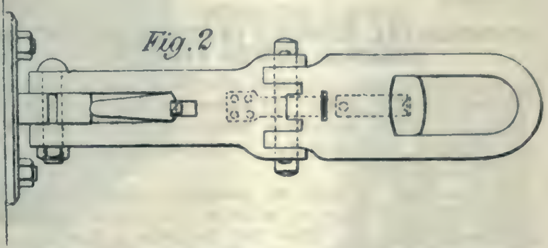


Fig. 4.

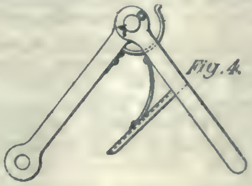


Fig. 5.

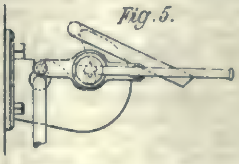
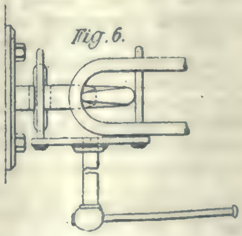


Fig. 6.



NEW PUBLICATIONS.

"MECHANICS FOR ENGINEERS."

A text-book of intermediate standard. By Arthur Morley, M.Sc. Longmans, Green and Co. 4s. net.

The aim of this book is to provide a suitable course in the principles of mechanics for engineering students. With this object in view the gravitational system of units has been adopted in the English measures. Graphical methods of solving problems have in some cases been used, by drawing vectors to scale, and by estimating slopes and areas under curves, the idea being that such exercises, although often taking more time to work than the arithmetical ones, which are specially framed to give exact numerical answers, compel the student to think of the relations between the quantities involved, instead of merely performing operations by fixed rules, and that the principles so illustrated are more deeply impressed. In view of the applications of mechanics to engineering, prominence is given such parts of the subject as energy, work of forces and torques, power and graphical statics. The ground covered is that required for the intermediate engineering examination of the London University.

"COMMERCIAL ECONOMY IN STEAM AND OTHER THERMAL POWER PLANTS."

As dependent upon physical efficiency, capital charges and working costs. By Robert H. Smith, A.M.Inst C.E. With numerous diagrams by H. Malcolm Hodson, M.I.Mech.E. Archibald Constable and Co., 24s. net.

The ultimate triumph of practical science must be evidenced in its demonstration of the means to attain maximum economy. This may be taken as the keynote of the present work, the main object of which, according to Professor R. H. Smith, is to persuade the mechanical engineer to advance from the primitive view that engineering science can guide him only in the physical construction and physical dynamics of his machinery to the much more complete idea that scientific method must also be applied to his reckonings of cost and of value produced. The author's opening remarks deal with commercial and industrial principles, economy, co-efficient measuring merits of cost, and speed of capital-utilisation, etc. The following chapters are headed: dynamic and thermal action, physical data, furnace, boiler and engine efficiences; costs, capital outlay and working expenses, steam, gas and oil plants, electric power stations, depreciation; kinetic energy and resilience, kinetic transpower and resilient transpower; irreversibility and heat transpower, stress and strain specific heats; analysis into thermal and mechanic elements, dynothermic co-efficient; first adjustment of size for maximum economy, dynothermic co-efficients of steam; work, heat and costs of actual indicator diagrams; partial limit values of bulk, initial pressure, and back pressure for maximum commercial economy; and combinations of best values for maximum commercial economy; furnace temperature and working speed for maximum economy. The author insists that mechanical resilience produced by heat-action is alone of any ultimate value to the power engineer and "condemns utterly the academic fetish of reversibility as an ideal unworthy to be striven after and approximated to." A valuable feature of the book is the number of excellent diagrams and tables which are not mere examples of the laws explained in the text, but in most cases are essentially the full graphical and numerical exhibition of all the practical results of these laws. In this short notice we are only able to briefly indicate the general scope of the work, which is one worthy of the serious study of every mechanical engineer.

NEW CATALOGUES.

The General Electric Company, Ltd., forward their new catalogue of Single and Polyphase Induction Motors. It is pointed out that the firm have recently made very rapid strides with their single and polyphase machinery and have been successful in obtaining many large and important contracts, amongst which are specially mentioned South London, Hastings, and Reigate for single-phase and Dublin and Cardiff for the three-phase. The catalogue is admirably illustrated, and the tabulated details are sufficiently useful to warrant a copy being secured and placed on file.

W. H. Palfreyman and Co., 17, Goree Piazzas, Liverpool.—"Case Hardening; What to use, How to do it." is the title of a suggestive little pamphlet received from this firm. We quote the following opinion on materials: There seems to be a very general opinion that different qualities of case-hardening materials are necessary for different kinds of work, but our experience of over twenty years in making a speciality of case-hardening materials has taught us that hydro-carbonated bone-black is best suited to all classes of work, excepting where the merest surface case is desired, and the uniformity of quality of the work is of no material value, and then a common bone meal of the cheapest quality is used.

Ruston, Proctor and Co., Ltd.—We have already called attention to some of the appliances used in the new and extensive boiler works at this firm at Lincoln. An exceptionally well-printed and illustrated pamphlet on these works and boilers has just been issued by the firm, and is likely to have a very wide circulation, the letterpress being in English, French, German, Italian, and Spanish. The works in question have been built in consequence of a constant increase in the firm's boiler business. The buildings and the installation of the machinery were completed in July, 1903, the first boiler being delivered on the 17th of the following October. We are informed that at the present time the following boilers are being made: Lancashire boilers, 19 ft. by 5 ft. 6 in. to 32 ft. by 9 ft. (from 80 lb. to 200 lb. steam pressure); Cornish boilers, 9 ft. by 3 ft. 6 in. to 28 ft. by 6 ft. (from 80 lb. to 150 lb. steam pressure); locomotive boilers, types "A" and "B" for coal, wood, vegetable, and petroleum fuel; also for firing with exhaust gas (from 90 lb. to 200 lb. steam pressure); flue and return-tube boilers, 9 ft. by 5 ft. to 16 ft. by 8 ft. 9 in., dryback type "J" (from 100 lb. to 160 lb. steam pressure); improved cylindrical multitubular boilers, type "EA" from 16 ft. by 4 ft. 6 in. to 16 ft. by 6 ft. (100 lb., 120 lb., and 140 lb. steam pressure); cylindrical multitubular boilers, type "D" 5 ft. by 2 ft. 3 in. to 14 ft. by 6 ft. 6 in (from 80 lb. to 140 lb. steam pressure); gold dredger boilers, type "G," (140 lb. steam pressure); cone tube boilers, type "K," 14 ft. by 5 ft. 6 in. to 30 ft. by 7 ft. (100 lb and 150 lb. steam pressure; vertical boilers, with cross tubes, type "L," (from 80 lb. to 100 lb. steam pressure); vertical boilers, with vertical tubes, type "LT" (90 lb. steam pressure); colonial portable boilers, type "O," (from 80 lb. to 100 lb. high pressure); colonial multitubular boilers, type "AC" (100 lb. steam pressure); petroleum drilling portable boilers (90 lb. and 100 lb. steam pressure). It is notified that the firm intend very shortly to put upon the market a high-class water-tube boiler.

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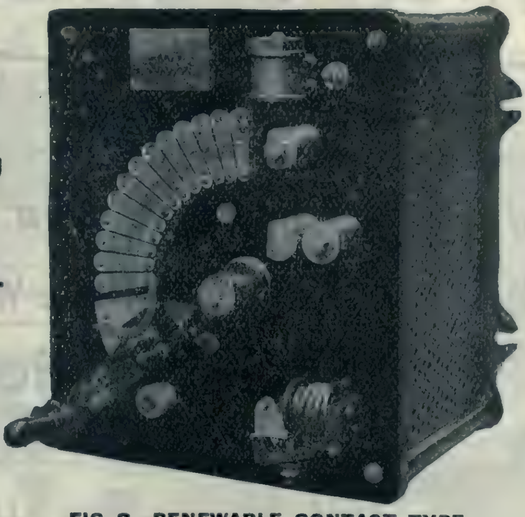

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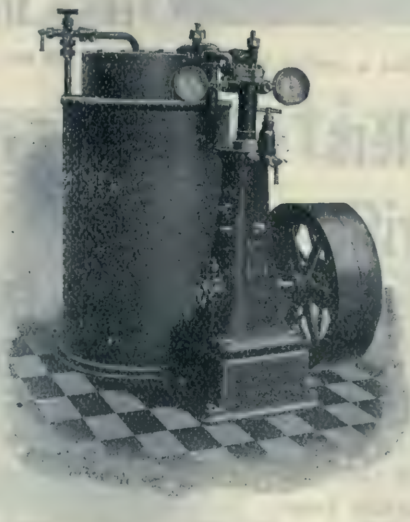

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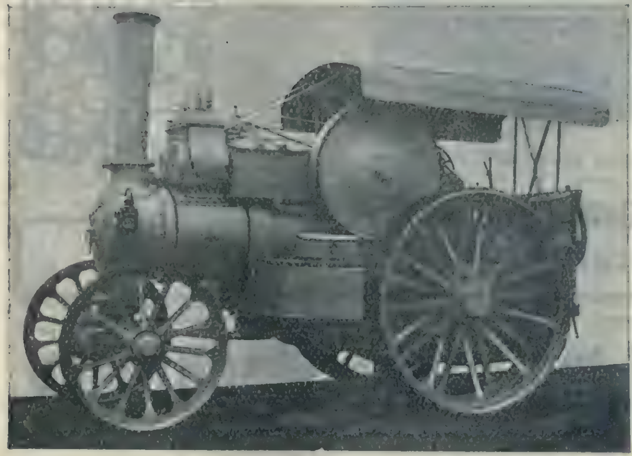

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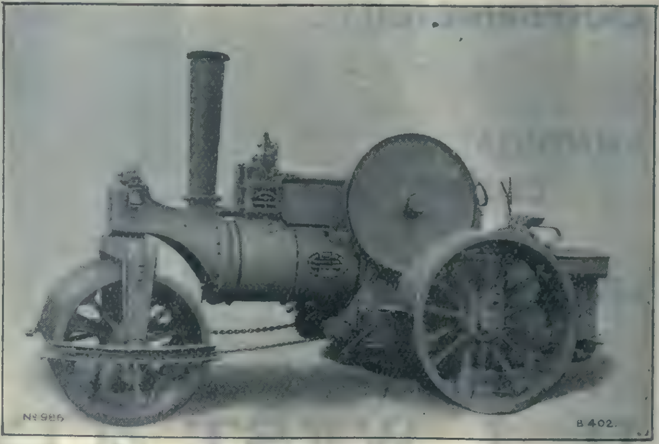

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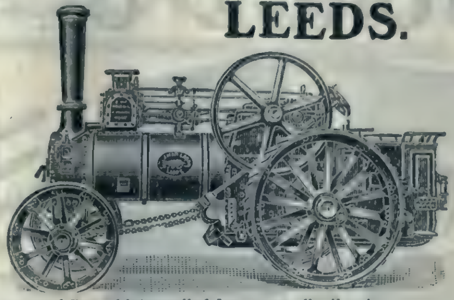

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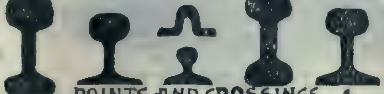

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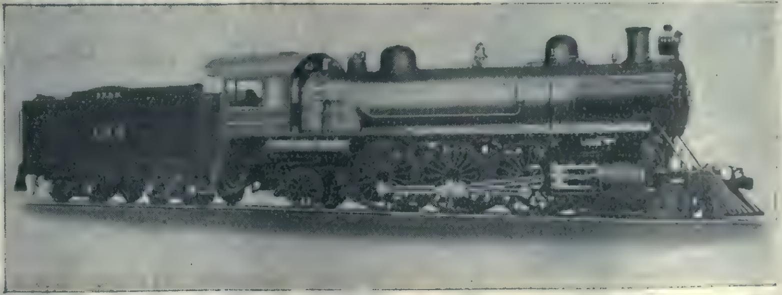

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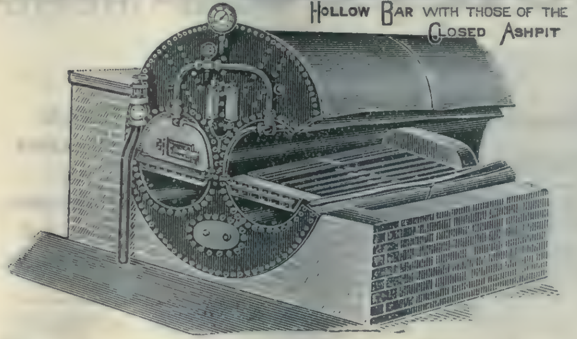

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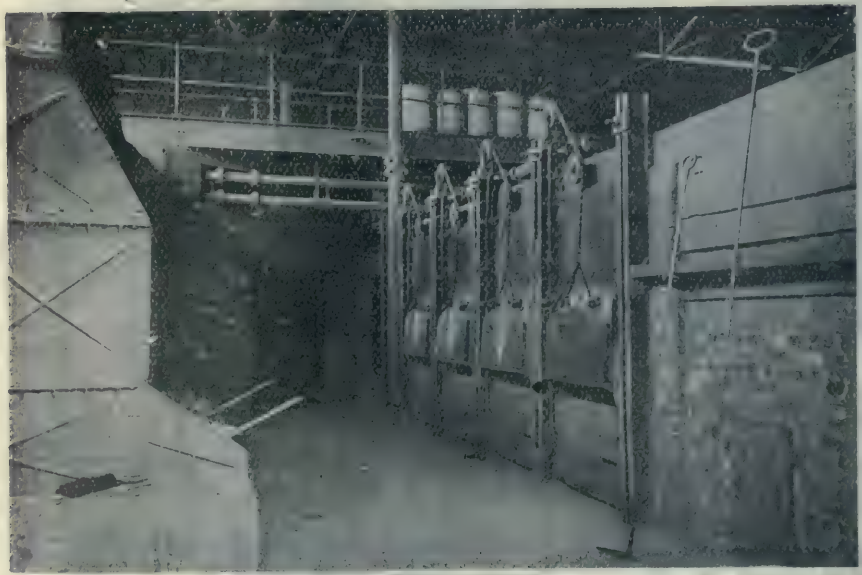

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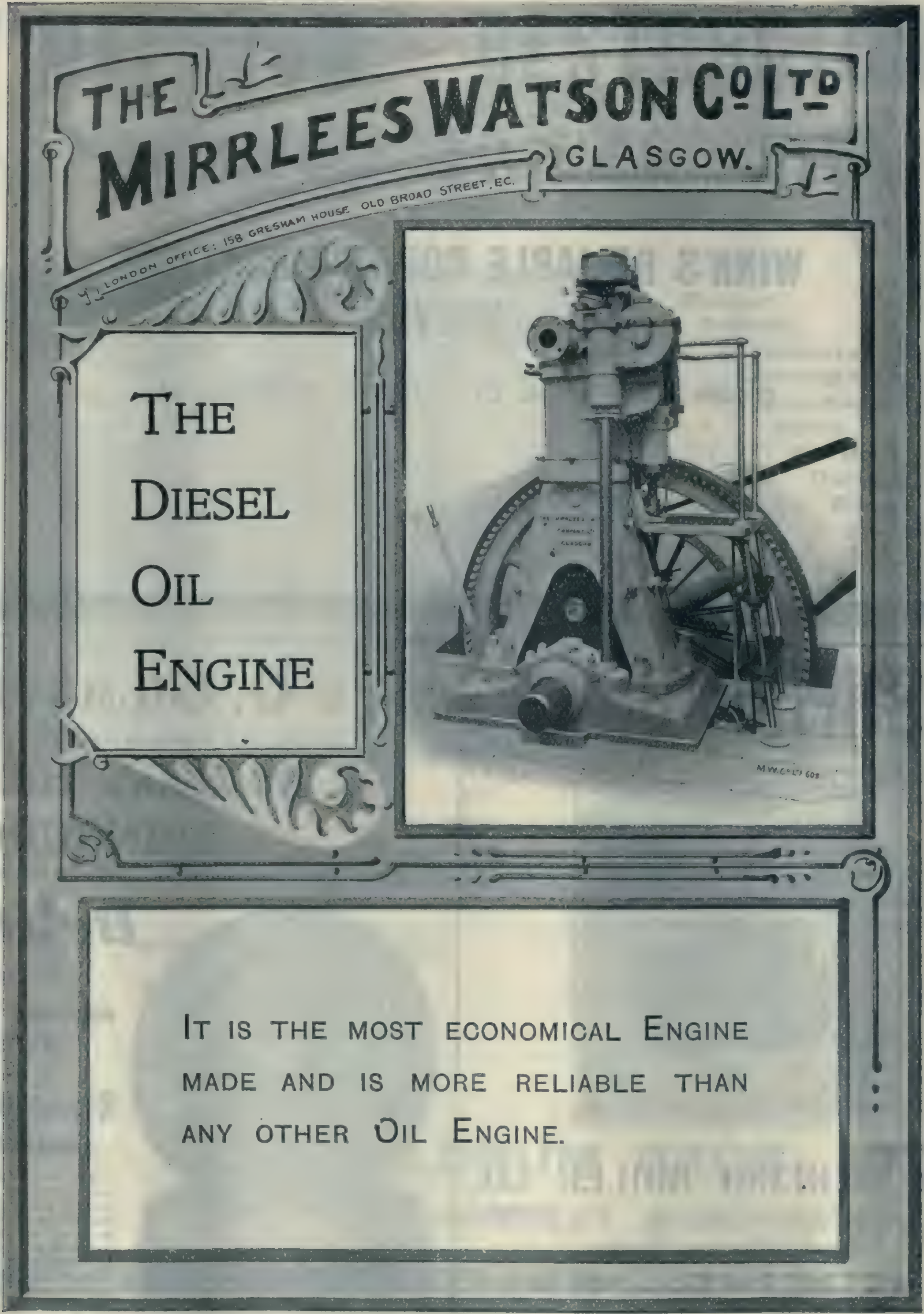

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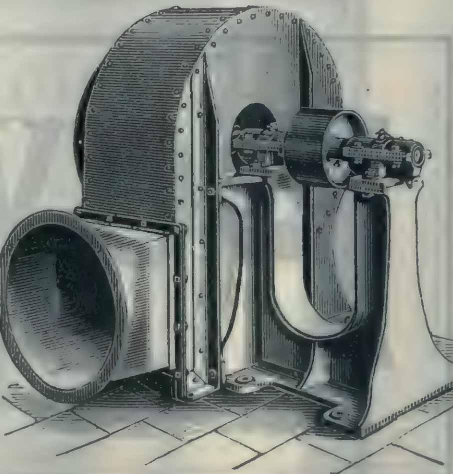

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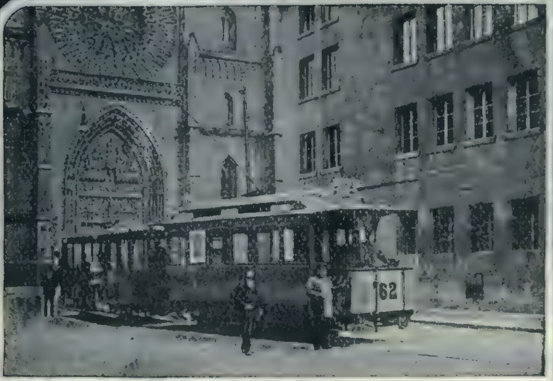

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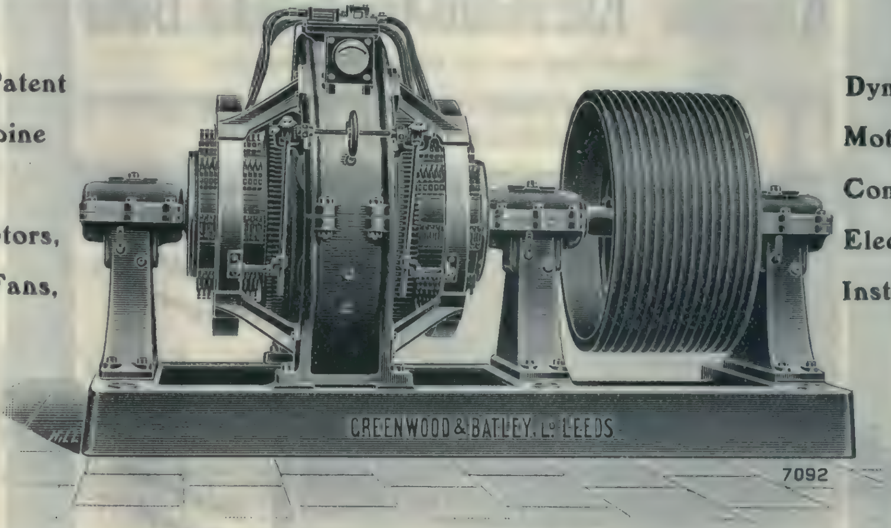

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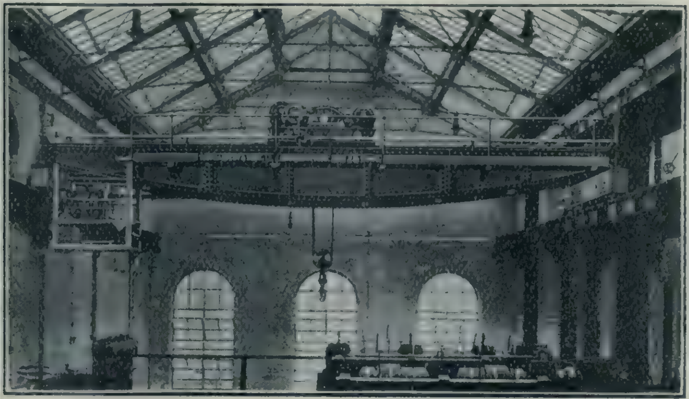

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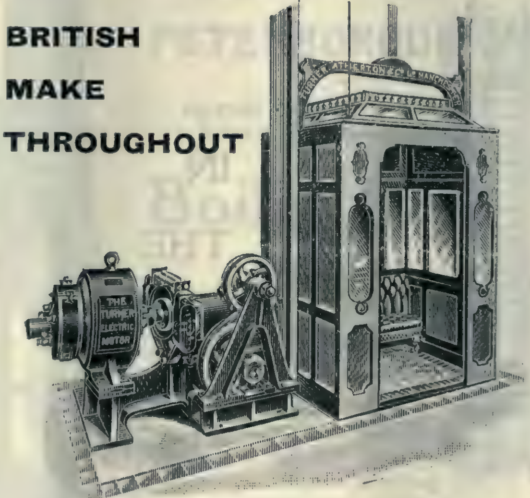

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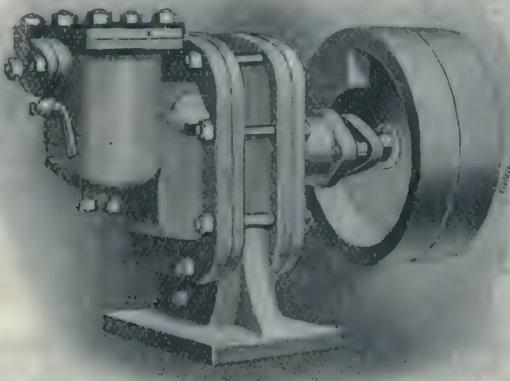

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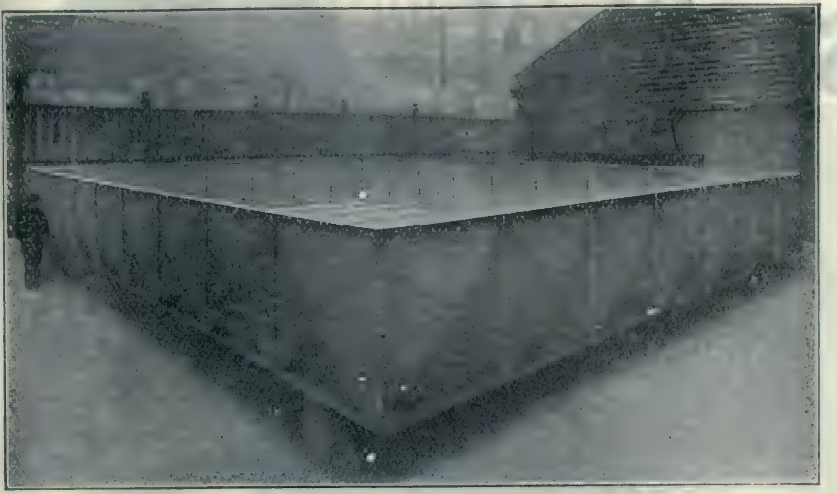

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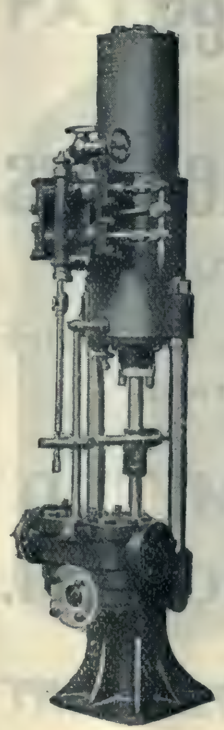

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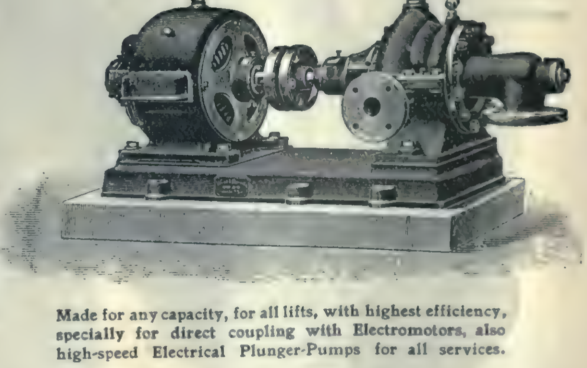

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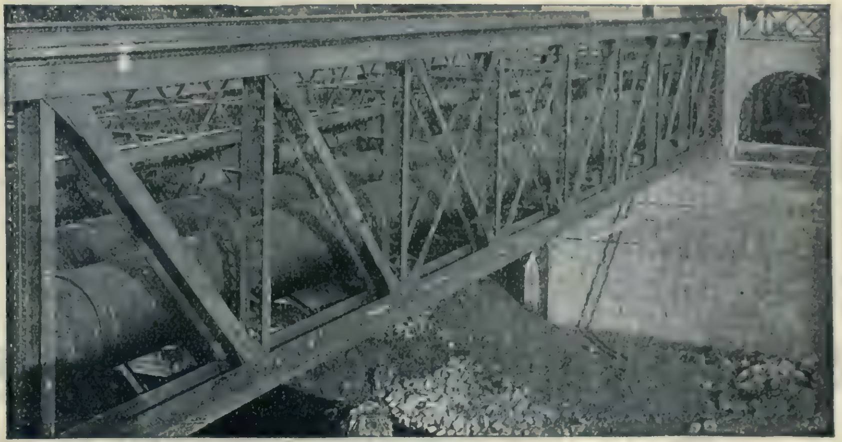

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Cabinet.

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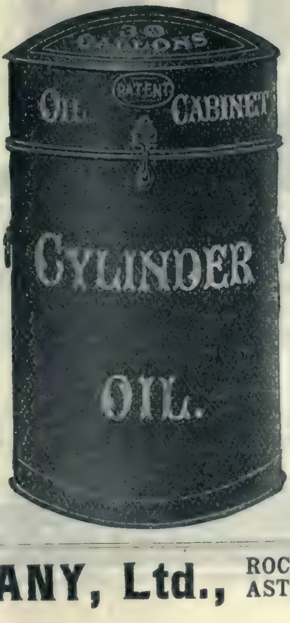

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Filters.

Made in
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To filter
from
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per week
to 90
gallons
per day.

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Steel Plates & Angles

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Tees, Bulbs, Zeds, Channels, Bulb Tees, and Angles,

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Material of the HIGHEST QUALITY manufactured, such as is used by the British and Foreign Governments for Shipbuilding and Engineering purposes.

OFFICES CONSETT DURHAM AND NEWCASTLE ON TYNE

PAGE'S WEEKLY Iron and Steel

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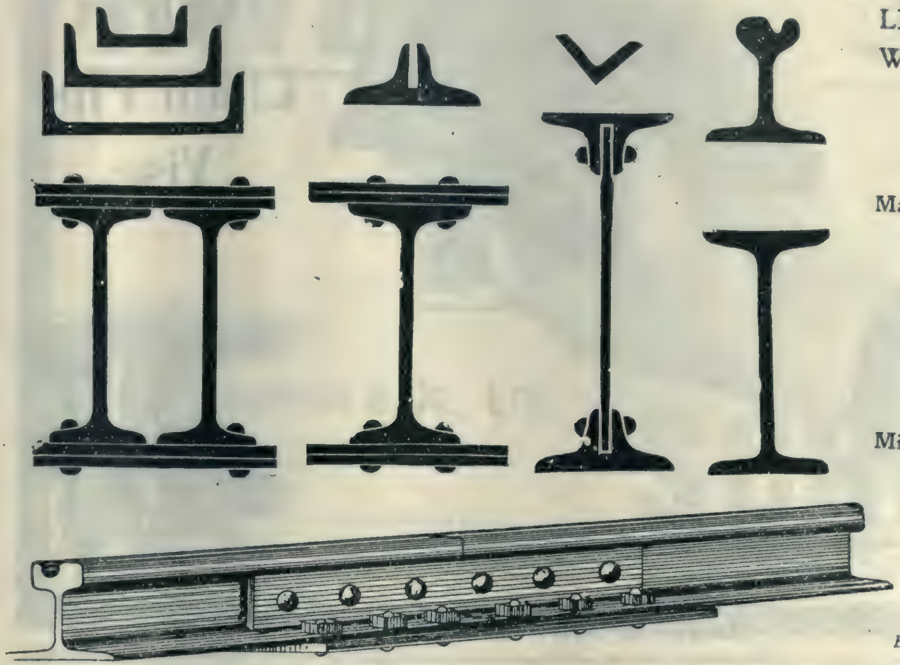

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Rolled Steel Joists, Channels, etc.

Mild Steel Blooms, Billets, Slabs, Tinbars, Rounds, and Flats

Speciality:

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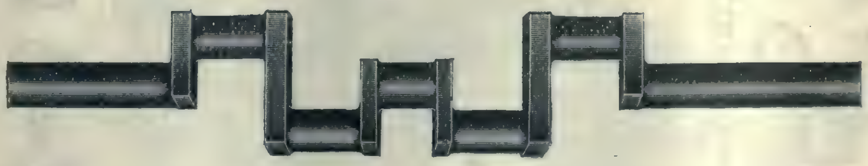

THOMAS SMITH & SONS,
Of Saltley, Ltd.,

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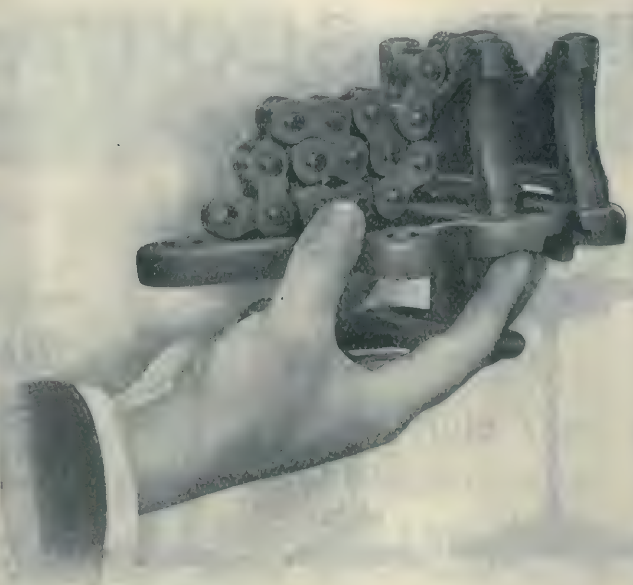
Celebrated
Vulcan
Chain Pipe
Wrench.



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ESTABLISHED 1817.

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FOR
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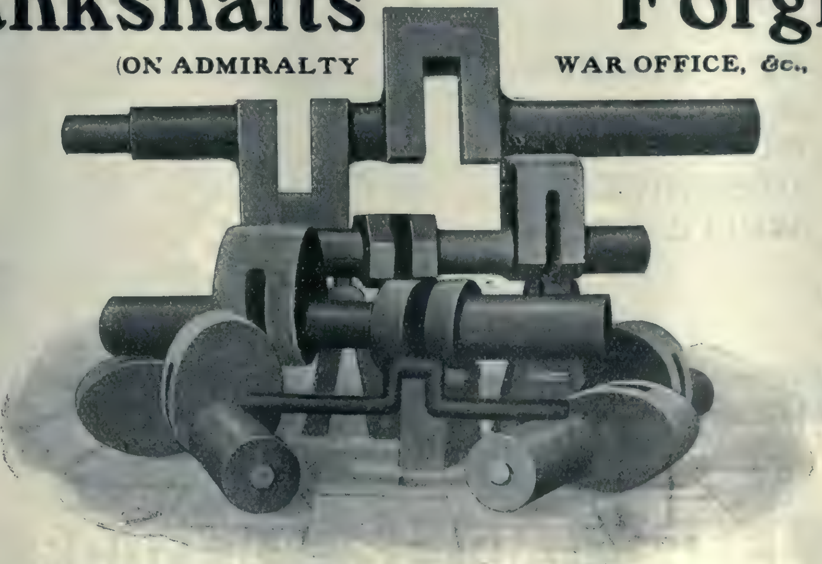

The above represents a Group of Crank Axles bent by hydraulic pressure, all throws bent in position, twisting being dispensed with.

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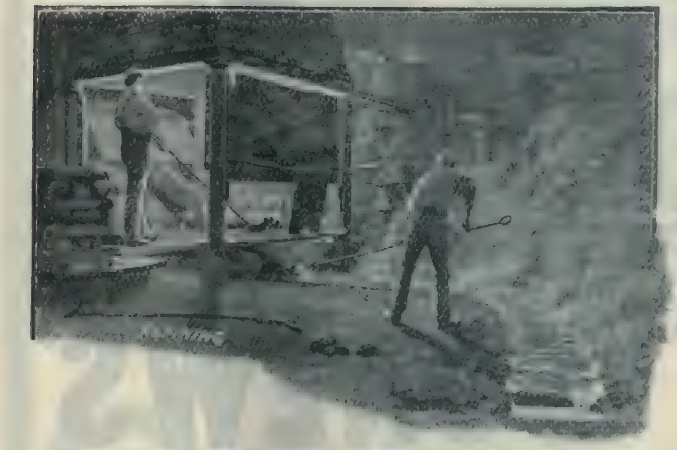
Farnley Iron



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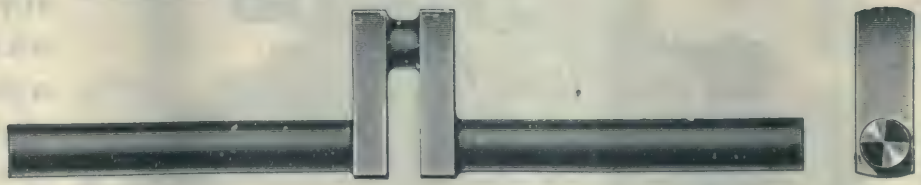

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SPECIALITY

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BOHLER'S STYRIAN STEEL
IN BARS, BLANKS, FORGINGS, DIES
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CORRESPONDENCE SOLICITED. PROMPT REPLIES. PROMPT DELIVERIES.

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FOR
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COLUMNS
AND
RIVETTED
STEEL
STANCHEONS.

STEEL
PIT HEAD
GEARS
AND
HEAPSTEADS
FROM
HEAD,
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TEESDALE IRON WORKS, THORNABY-ON-TEES;
STOCKTON FORGE WORKS, STOCKTON-ON-TEES;
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SPECIAL!!!
5 WHEEL NUMBERING MACHINE
21/-
COMPLETE.
ONE SIZE FIGURE ONLY.
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STEEL WHEELS:
SELF-INKING
TRIPLE ACTION.
CHANGES AUTOMATICALLY.

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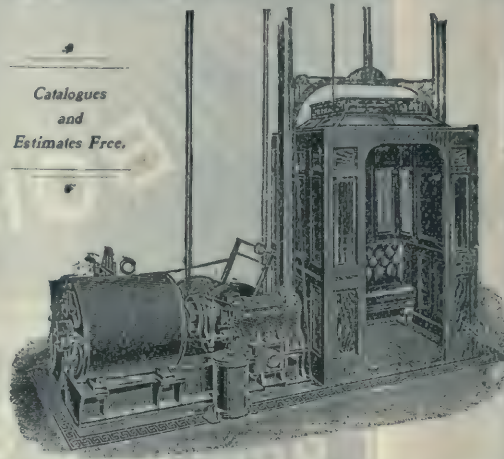
By Special Appointment to H.M. the King.



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The Shannon Letter Copier.

Dealing with Correspondence.

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SECOND: File the copies of answers with the original letters received in a **Shannon Letter Filing Cabinet**, in alphabetical and chronological order.

THE RESULT:

Perfect Copies. Instant reference to outgoing and incoming correspondence. Great saving of time, worry, and hard cash.

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Write for our Booklet No. 20, which deals exhaustively with this modern system.

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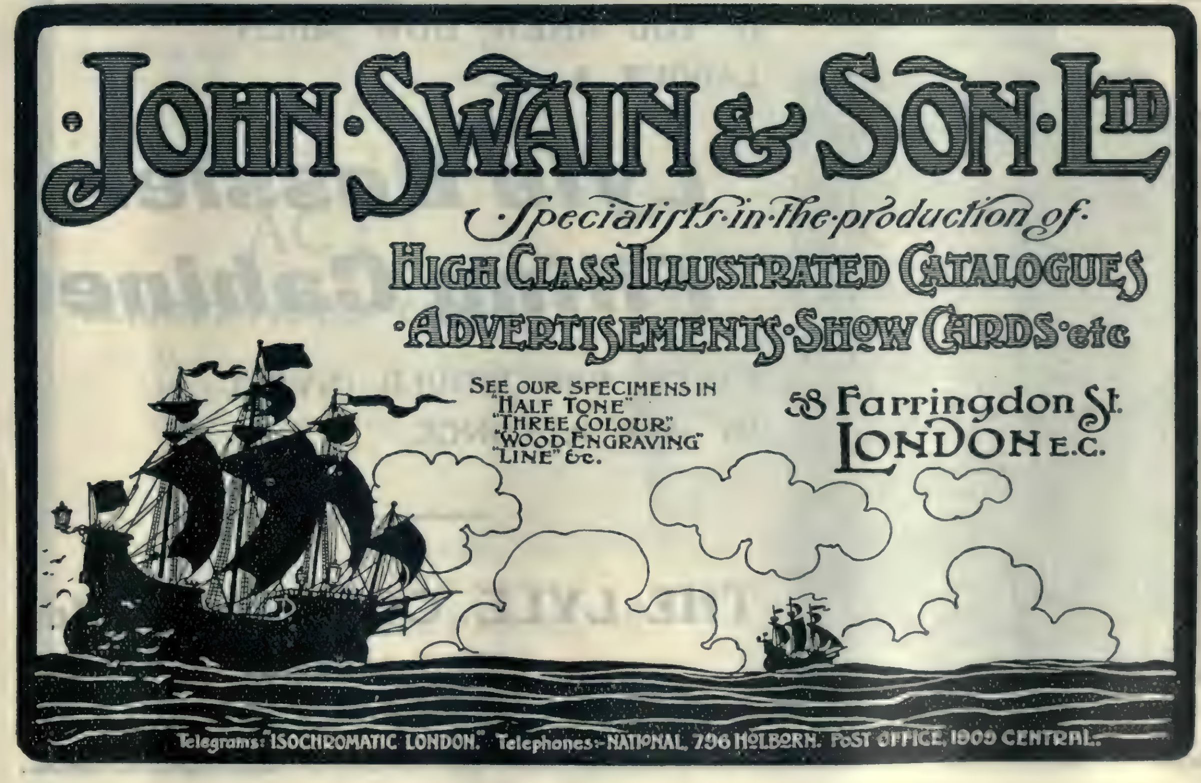

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"BEDFORD BOND"

Manufactured in White and Five Tints. Specially adapted for Departmental Stationery.

SUPERFINE TYPEWRITING PAPER.

IF YOU KNEW HOW MUCH LABOUR A - - -

Lyle Dossier Filing Cabinet

SAVES, YOU WOULD INVEST IN ONE AT ONCE.

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GRAY'S INN ROAD,
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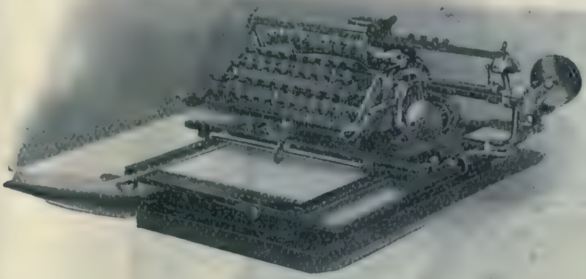
PAGE'S WEEKLY Billing Machines



THINK!

¶ Think of the millions of bills made every day!

¶ Now think how big a thing it is to save a little time and a little expense on every one of them!

¶ Then think of doing ten things at once; bill, order, record, and so on.

NOW THINK OF

ELLIOTT-FISHER BILLING MACHINES

AS A TIME AND EXPENSE SAVER IN EVERY BILLING AND BOOK-KEEPING DEPARTMENT IN THE LAND!

¶ Once more think that there is no business system so complicated that ELLIOTT-FISHER Machines and methods won't simplify, and that there is no system so simple that ELLIOTT-FISHER Machines and methods won't save time and expense in working it!

¶ Needn't think any more, it's time to

ACT!

ELLIOTT-FISHER COMPANY,

Makers of the only real Billing Machine. If anyone tells you of any other billing machine look wise and wink.

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Indispensable to Employers of Labour.

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BY
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TIME
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COST
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(ON SAME MACHINE.)

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Head Office: 40, Paradise Street, LIVERPOOL.

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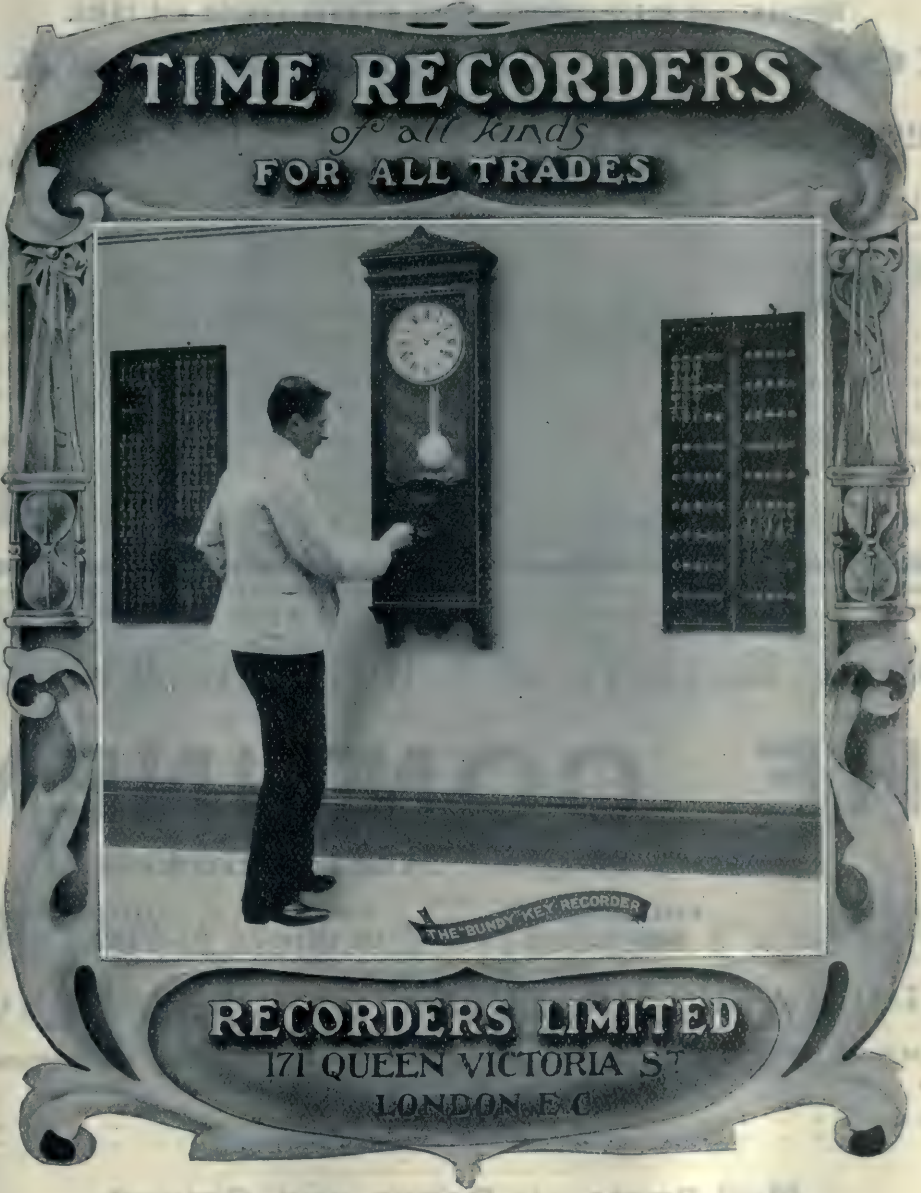

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of all kinds
FOR ALL TRADES

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AND

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†* 9.0 a.m. (Charing Cross Station)	For PARIS only	4.45 p.m.
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† 11.0 a.m. from	Victoria Station	6.45 p.m.
‡ 9.0 p.m. „	Charing Cross Station ...	5.50 a.m.

Depart. from Paris.		Arrival in London.	
† 8.30 a.m.	For Intermediate Stations	4.55 p.m.	Charing Cross Station.
†* 9.50 a.m.	For CALAIS only		
†* 11.35 a.m.	... ...	6.45 p.m.	Victoria Station
‡ 8.40 p.m.	... Intermediate Stations	5.40 a.m.	Charing Cross Station.

Via FOLKESTONE AND BOULOGNE.

Depart. from London.		Arrival in Paris.
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†* 2.20 p.m.		9.15 p.m.
‡ 2 20 p.m.		11.25 p.m.

Depart. from Paris.		Arrival in London.	
‡ 8.30 a.m.	Intermediate Stations	... 3.45 p.m.	Charing Cross Station.
‡ 2.40 p m.		10.45 p.m.	
†* 4.9 p.m.	For Boulogne only ...		

† 1st and 2nd Class only. ‡ 1st, 2nd, and 3rd Class. * Restaurant Car between Paris and Calais or Boulogne, and *vice versâ*.

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Four Royal Mail Routes

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LONDON-PARIS IN LESS THAN SEVEN HOURS

Five Services Daily in Each Direction.

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Two Services Daily in Each Direction.

For Full Particulars see S.E. & C.R. Continental Time Tables, price 3d.

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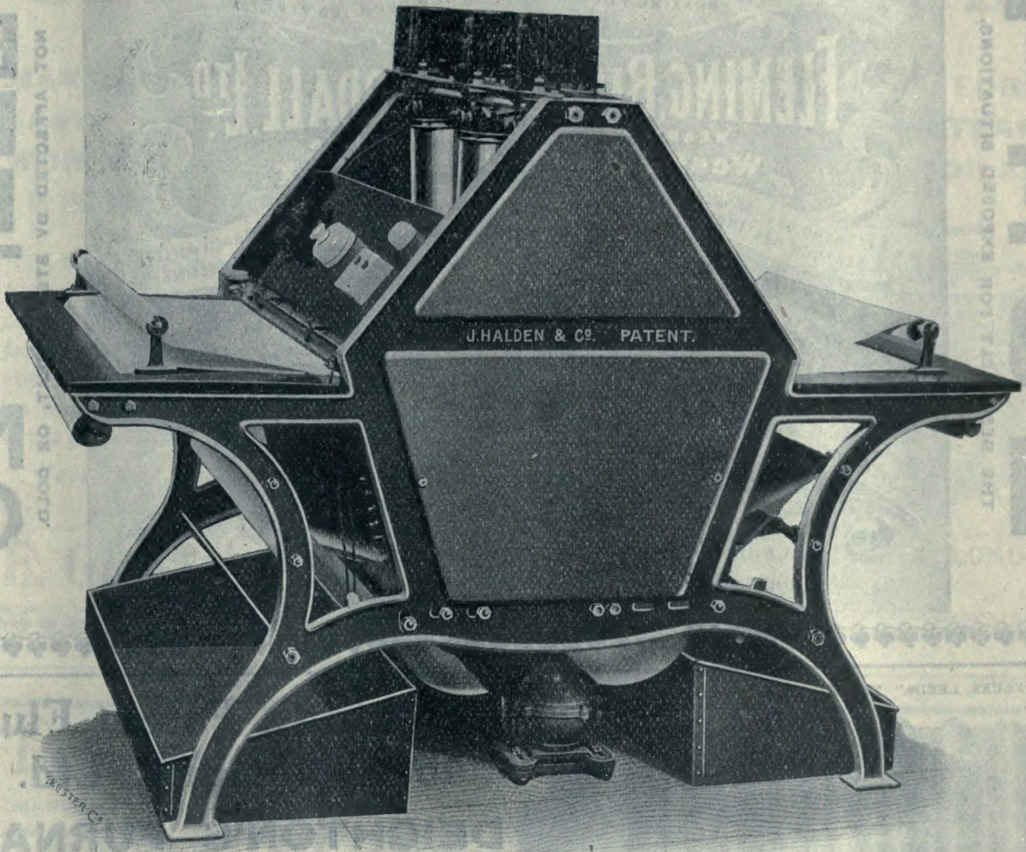

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Illustrated Descriptive List Free Post on request. . .

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STANDARD OAK-TANNED LEATHER BELTING.

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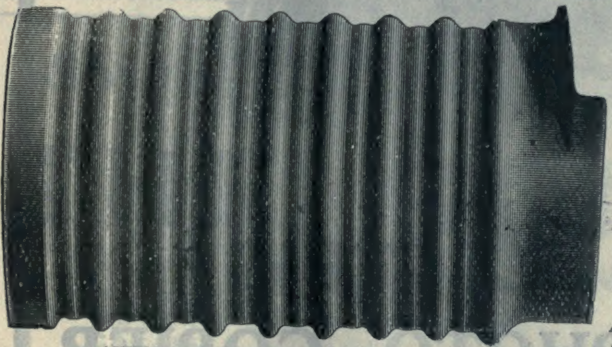

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DEIGHTON'S FURNACE.

The Destructive Tests have proved the DEIGHTON FURNACE to be the strongest to resist collapse ever made.

It is also unequalled for Uniformity of Thickness and Easy Scaling.

MAKERS OF MARINE and LAND BOILER FURNACES.

Awarded 2 Bronze Medals, Paris Exhibition, 1900.

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4/-	5/6	9/-	11/6	16/-

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LIBERAL DISCOUNT.

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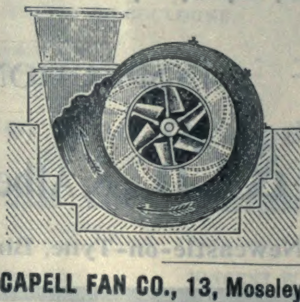

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(In large use).

Induced & Forced Draught Fans.

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ADVANTAGES:–
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Small Size of Fans.

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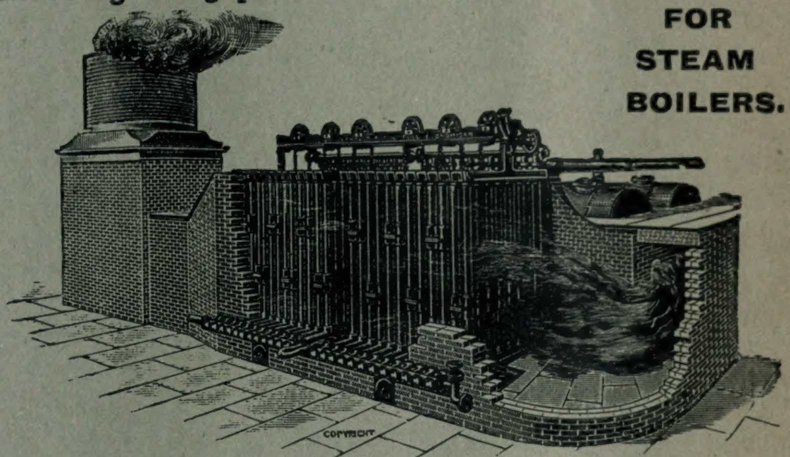

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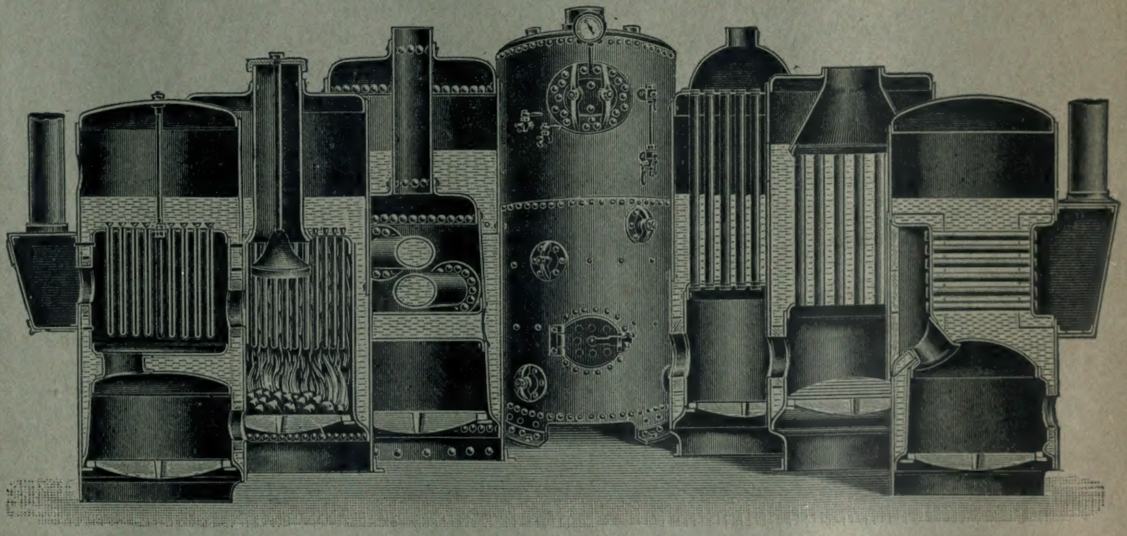

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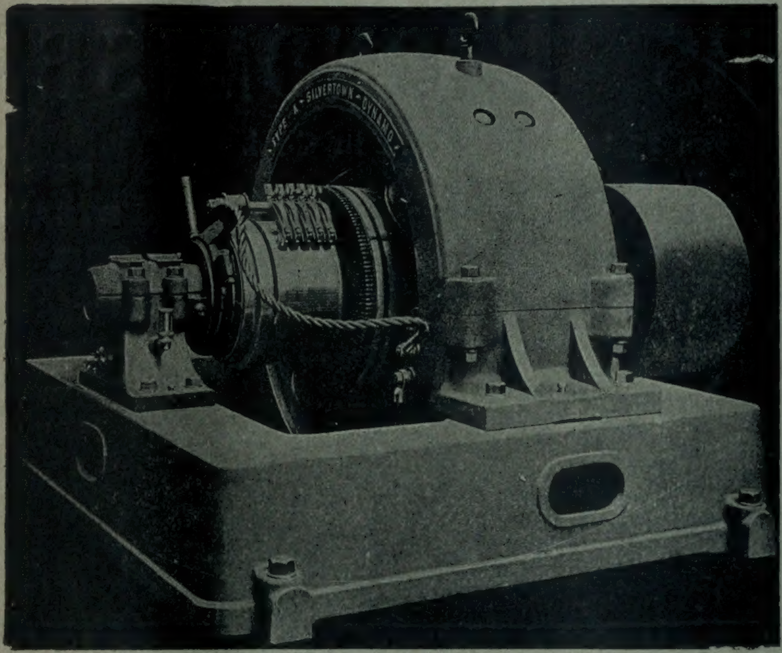

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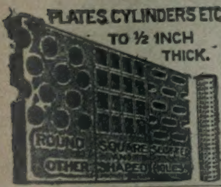

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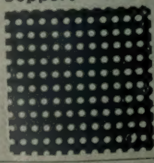

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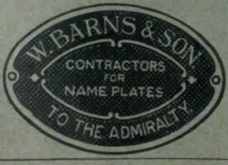

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